THE HEATING AND VENTILATING MAGAZINE

Vol. IX. No. 3. $1.00 a year. 10 cents a copy

NEW YORK, MARCH, 1912

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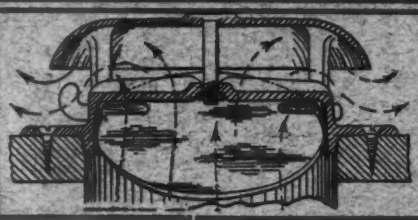

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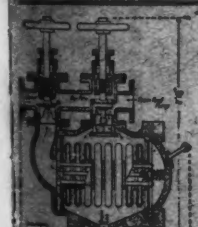

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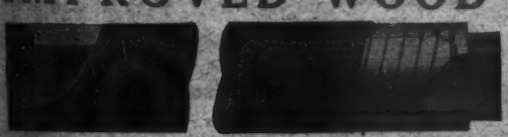

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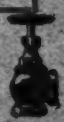

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK MARCH, 1912

The Federal Heat Unit at Work

The past month marked a notable event in the trade in the publication of the much-heralded Federal System of Heating and Ventilation, prepared by the Federal Furnace League and intended for use in connection with the design and installation of warm-air furnaces.

Much curiosity will be gratified when it is stated that the Federal Heat Unit (F.H.U.), which forms the basis of the system, is a fixed number of B. T. U. and is used instead of the latter term in order to simplify calculations by making them in relatively small figures. For instance, in figuring the heating requirements of a room, on a zero to 70° F. basis, the first step, with the Federal System, is to compute the number of square feet of glass exposure. To this a certain percentage for exposure is added. The sum thus obtained, plus one-sixth of the number of square feet of net wall exposure, constitutes the heating requirements of the room in Federal Heat Units. In other words, a Federal Heat Unit is practically the number of square feet of glass exposure and of equivalent glass exposure. The number of Federal Heat Units in each room determines the required sizes of warm air cellar pipe, warm air riser pipe, warm air register and the dimensions of the ventilating duct and ventilating register for said room. Tables have been prepared covering each one of the above named items.

After the heating requirements of the building in Federal Heat Units is obtained by figuring each room and hall according to the method outlined, the proper-size furnace is the one capable of supplying that total of Federal Heat Units, because the furnaces are officially rated by the League in Federal Heat Units. Architects and heating contractors are furnished by the members of the League with correct and official capacity ratings of their furnaces. Every furnace rated by the League has this official rating published in the catalogue of the member who manufactures it, and also has the rating affixed to the front of the furnace on a plate designed for that purpose or cast permanently thereon. The public generally is aware that the tests to determine these capacities are not made, nor are the ratings assigned, by the members themselves, but by the consulting engineer of the League, Dr. William F. Colbert, who is employed for this purpose.

The total number of Federal Heat Units in the entire building determines the required dimensions of the chimney flue and fresh air duct, and both items are covered in the League's tables.

Emphasis is laid on the fact that the ratings assigned to furnaces by the Federal Furnace League denote capacities only and have no bearing upon the relative merits of the various furnaces as to durability and economy.

Members of the League are authorized to use an imprint on their printed matter whereon appear ratings of their furnaces which have been duly assigned by the League, the imprint stating that they have been properly tested and rated by the League and warranting the furnace to be capable of sustaining its rating in actual use.

THE FEDERAL SYSTEM AN EXHAUST METHOD

With a furnace of adequate capacity, with the warm air and ventilating pipes, flues and ducts properly proportioned as stipulated by the rules of the Federal System, the air is designed to be drawn out of the different rooms, from each in proper volume, as soon as the fire is started in the furnace, and the warm air from the heating chamber to flow into each room in proper volume to meet the heating requirements. The Federal System is, therefore, an exhaust gravity method of heating and ventilating. The League furnishes to its members and to architects official proposal and specification blanks for use in connection with and to promote the installation of the Federal System. There are separate blanks for heating alone and for heating with formal ventilation.

In explaining its adoption of the Federal Heat Unit as the standard of measurement, the League states that it has long been rcognized that the relation between the cooling effect of wall exposures and of glass exposures, as determined by experiments conducted in "still air," are not valid with the wind velocities encountered under actual heating conditions. The heat loss through glass and the relation of coefficients for wall exposures, etc., to those for glass exposures, as used in the League's handbook, have been determined by a series of exhaustive original experiments under various artificially produced wind velocities.

The increased furnace capacity required for poor grades of bituminous coal or lignite is figured by the League as from 25% to 33⅓% above that computed by the foregoing method.

In some notes and explanations applying to the rule for computing heating requirements, it is stated that the surfaces to be figured as regular single glass exposure include outside doors, not vestibuled; ordinary single windows and single skylights. Surfaces counted as 50% of regular single glass exposure are outside doors, vestibuled; double windows, windows fitted with storm sash, and double skylights. The surfaces to be counted as net wall exposure include actual number of square feet of outside wall surface, floor and ceiling of overhanging bay windows. Surface to be counted as 50% of net wall exposure includes party walls and partitions (including doors) between heated and cold rooms. When the walls of a building are of concrete, one-fourth of the number of square feet of net exposed wall surface is to be taken, instead of one-sixth.

GENERAL DIRECTIONS FOR THE INSTALLATION OF WARM AIR FURNACES

In connection with its system of heating and ventilation, the League presents the following rules upon which, it is stated, the validity of the whole scheme depends:

Rule 1.—Each warm air pipe must have an upward pitch in the cellar or basement from the furnace of not less than 1 in. per foot. It is desirable, where conditions will permit, to have much more than 1 in. to the foot pitch.

Rule 2.—The pitch of all warm air pipes, less than 15 ft. long in the cellar or basement, should be alike. The equalization of pitch is attained by bringing down lower into the cellar the boots of the shorter warm air pipes than those of the longer warm-air pipes.

Rule 3.—When a warm air pipe in cellar or basement is more than 15 ft. long, add ½-in. to the diameter of such pipe for each 5 ft., or part thereof, of length in excess of 15 ft. (or when odd ½-in. sizes of pipe are not used, add 1 in. to diameter of pipe for each 10 ft. or part thereof, of length, in excess of 15 ft.); and in such a case the riser must be increased in capacity to equal the capacity of the cellar or basement pipe. An offset in the riser pipe is equivalent to an addi-

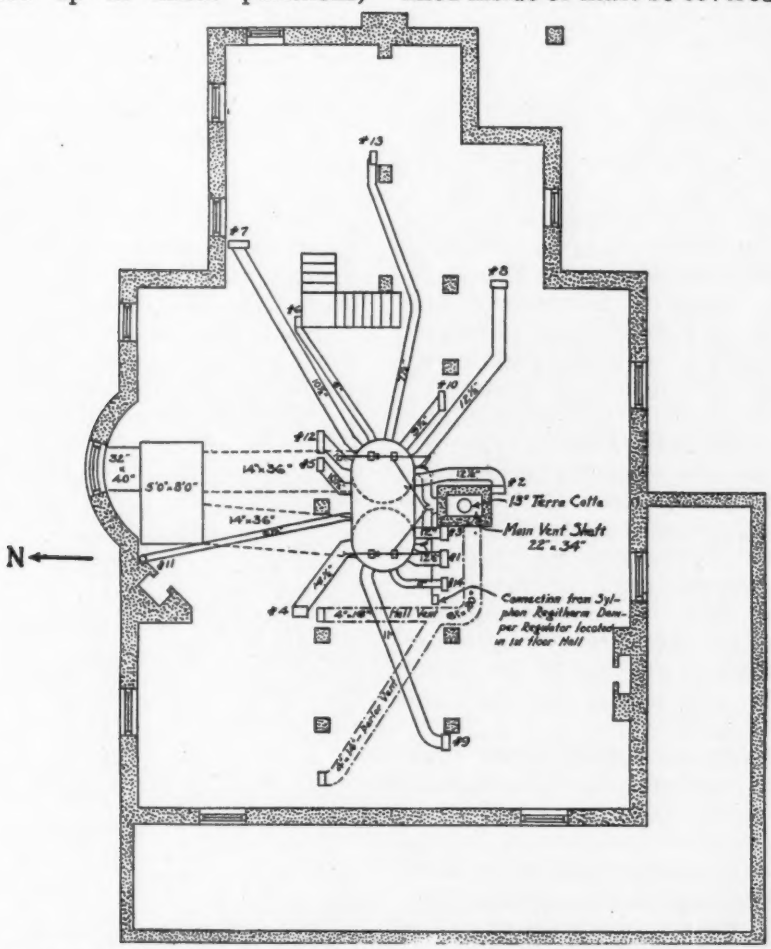
tion of the length of the cellar pipe and should be counted in when measuring the total length of the cellar pipe.

Rule 4.—All warm air pipes in cellar or basement must be covered with good non-conducting pipe covering.

Rule 5.—All warm air risers should be carried up in inside partitions, wherever possible, and should be "double wall pipe," or should be single pipe installed according to the fireproofing method as described in the League's handbook. If double wall pipe is used, the capacity should not be reduced. If cases arise where it is absolutely necessary to carry up warm air risers in outer walls, such risers must be so thoroughly protected with covering as to be completely insulated from the cooling effect of the outside temperature.

Rule 6.—A separate compartment should be made in the crown of the furnace or bonnet of the furnace for each extra long or tortuous warm air pipe, thus insuring a positive supply of warm air to that pipe.

Rule 7.—The furnace must be double cased, or the casing must be lined inside or must be covered outside with a good non-conducting material covering.



TYPICAL LAYOUT OF WARM AIR FURNACE HEATING SYSTEM, FOR LARGE COUNTRY RESIDENCE, ACCORDING TO FEDERAL SYSTEM OF HEATING AND VENTILATION

Rule 8.—Each warm air pipe, except one, should be provided with a tight disc damper.

Rule 9.—The furnace must be attached to a chimney flue of correct construction; one which will furnish sufficient draft to insure a good combustion of the fuel.

Rule 10.—The fresh air supply to the furnace must be adequate.

Additional directions are given for

installing heat pipes in partitions, using both the double pipe and fireproofed single pipe method; for heating open halls in a residence, which, it is stated, should be from a register in the first floor hall; for heating a room with two or more pipes, for heating two rooms with one pipe and for trunk line piping. Also for installing two furnaces for heating a large house, for designing a fresh air supply, fresh air duct and fresh air room.

FORMAL VENTILATION PROVIDED

One of the features of the Federal System is its provision for formal ventilation. This arrangement is described by the League as consisting principally of a large shaft or stack to be built instead of the ordinary chimney flue. A tightly-joined terra cotta or metal pipe should be run up through this shaft for the furnace draft. The best draft pipe for this purpose, it is stated, is the cast-iron pipe, while cast sewer pipe is admirably adapted to the purpose, as is also wrought iron pipe. Sheet metal pipe, if made of iron, may also be used if properly constructed of heavy gauge material. The number of Federal Heat Units in the rooms to be ventilated through the shaft determines the required size of the ventilating shaft, which may be computed from the tables given.

The space around this pipe forms the main ventilating shaft. From the ventilating register in each room a ventilating dust duct or flue is connected to the main ventilating shaft. Ventilating registers, according to the League's recommendations, should be located on inside partitions at the floor line or in the floors of rooms and not in outer walls and, when the warm air register is located at or near the floor, the ventilating register should be placed not less than 4 ft. away from the warm air register.

The heat from the smokepipe causes a strong upward current in the air surrounding it and this draws in the air through every ventilating register connected by the ducts to the main ventilating shaft.

Another way proposed by the League to provide a ventilating shaft is to build a double flue, using one part for the smoke exit and the other, the larger, part for the ventilating shaft. If the partition between the two flues is not too thick, the ventilating shaft will be sufficiently heated to serve the purpose.

THE FEDERAL SYSTEM AS APPLIED TO SCHOOL BUILDINGS

The foregoing methods suggested by the League are applicable to residences and similar buildings, only. The heating and ventilating of school buildings in accordance with the State laws requiring 30 cu. ft of fresh air per minute for each pupil, requires a different system of installation and greater furnace capacity than that already described.

The first step, as before, is to find the heat requirements for each room in Federal Heat Units by computing the number of square feet of glass exposure, adding a percentage for the exposure of the building and then adding one-sixth of the number of square feet of net wall exposure. Up to this point the steps are the same. For schoolrooms, however, the next step is to deduct 60% of the total as above obtained. Then, if the room is a class room, add 9 Federal Heat Units for each pupil the room is intended to accommodate; or, if the room is an assembly room, teacher's room or corridor, the total should be multiplied by four instead of making the addition for the number of pupils. Special tables are presented for rooms figured on this basis covering the required sizes of the warm air cellar pipe for said room, warm air riser pipe, warm air grille or register, ventilating duct, ventilating register, etc.

The League's handbook includes detail plans of a warm air furnace installation for both a large and a small country residence, designed and installed according to the Federal System of heating and ventilation. All of the principal calculations in each case are given in detail, showing how the Federal Heat Unit is made use of in arriving at the furnace capacity.

The book containing the full details

of the Federal System of heating and ventilation is issued "for the use of architects, heating contractors and the building trade," and a copy may be obtained by addressing the Federal Furnace League, Philadelphia.

Ventilation of a Steam Laundry*

By A. M. Feldman

In the report of the New York State Commissioner of Labor for 1908, 1909 and 1910, there is given a table showing the condition of air as found by the Factory Inspectors in various industries, among which are given figures of conditions in laundries.

Excluding all cases where the outdoor temperature was over 70° F., the report states that there was not a single laundry visited by the inspectors where the temperature was found to be 72° F. or less. Seven laundries had temperatures from 73° to 79° and seven 80° or over. The relative humidity in some of those laundries was over 70%.

The laundry described in this paper was designed by the author last Spring for the New York Barber Towel Supply and Steam Laundry Co., at East 32nd Street, New York City. It consists of three stories and basement, each 88 ft. long by 51 ft. wide, while the first floor is 95 ft. long, the height of the ceilings being 14, 13 and 12 ft., respectively. The cubic contents are 67,830, 58,340 and 53,850 cu. ft.

The soiled towels and napkins are taken up on an elevator to the top floor where they are washed in revolving washers; the moisture is removed from them in extractors. Then they are delivered through chutes to the two lower floors where they are passed through steam mangles to be dried and ironed.

The building is exposed north and south with large glass surfaces. Coils and wall radiation are provided under the windows to compensate the heat losses through these areas.

To remove the steam rising from the washers on the top floor and steam and excessive heat from the mangles on the two lower floors, each floor is provided with a multivane exhaust fan and a system of ducts and hoods over the mangles.

Fresh air is supplied through the lower halves of two windows in opposite walls on each floor of the building, where Vento-indirect radiators were installed to temper the air. The free area of each stack is 6.5 sq. ft. The system provides a uniform distribution of fresh air without any drafts. The air is drawn toward the hoods by exhaust fans.

The workers at the mangles in hot summer days feel a breeze as fresh air is moving over them toward the hoods. There were no hoods provided over the washers on the top floor for fear of interfering with the cold and hot water and steam pipes. The ducts have a number of wire-screened openings.

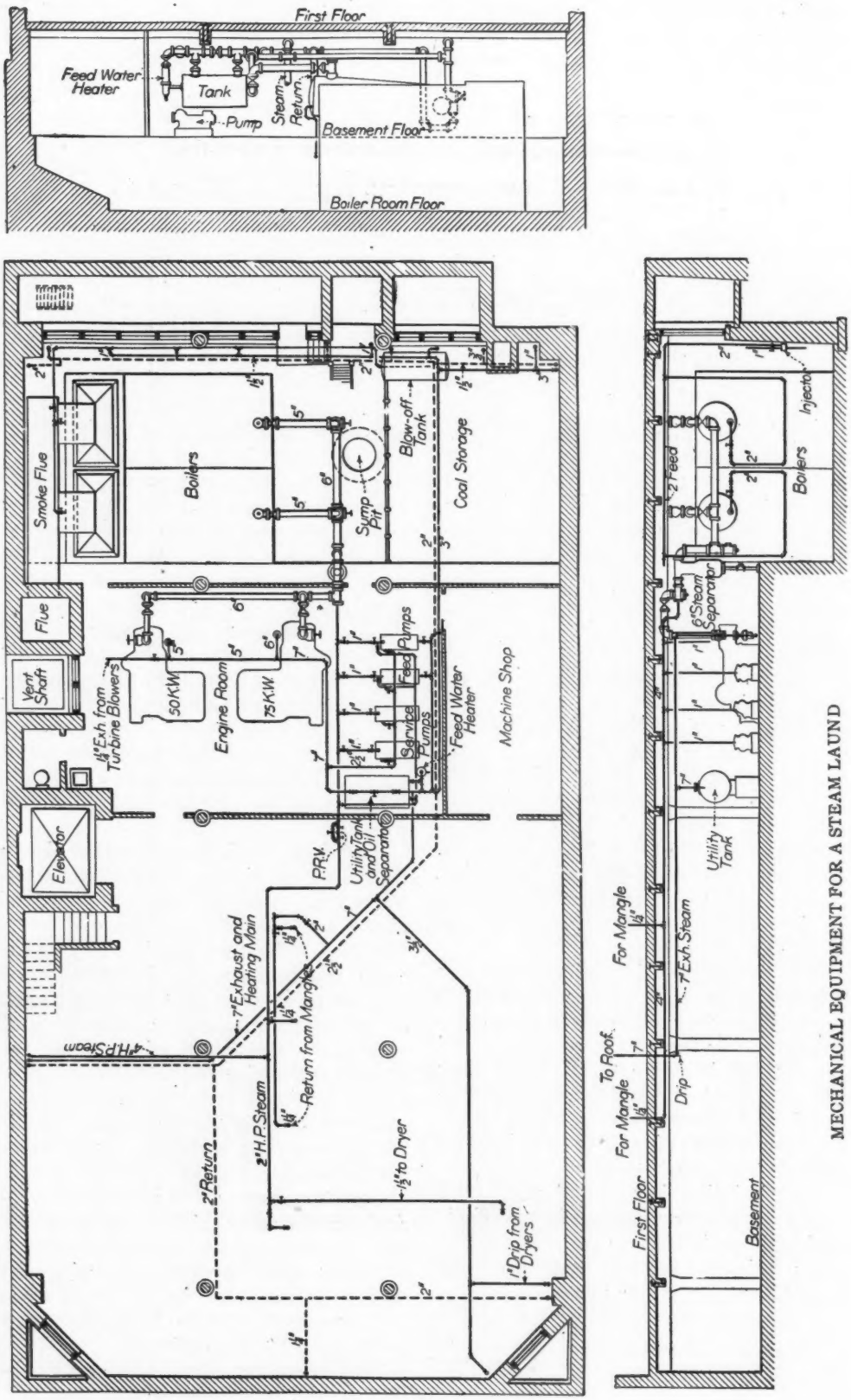
The fans on first and second floors are 36 in. multivane type, running 350 R. P. M. with a rated capacity of about 750,000 cu. ft. of air per hour. On the top floor the fan is 30 in. multivane running 450 R. P. M. and of rated capacity of about 570,000 cu. ft. of air per hour. Only in very cold weather is the speed of the fans reduced; otherwise they are running at full speed.

The following tests carried on with a sling psychrometer may be of interest to record:

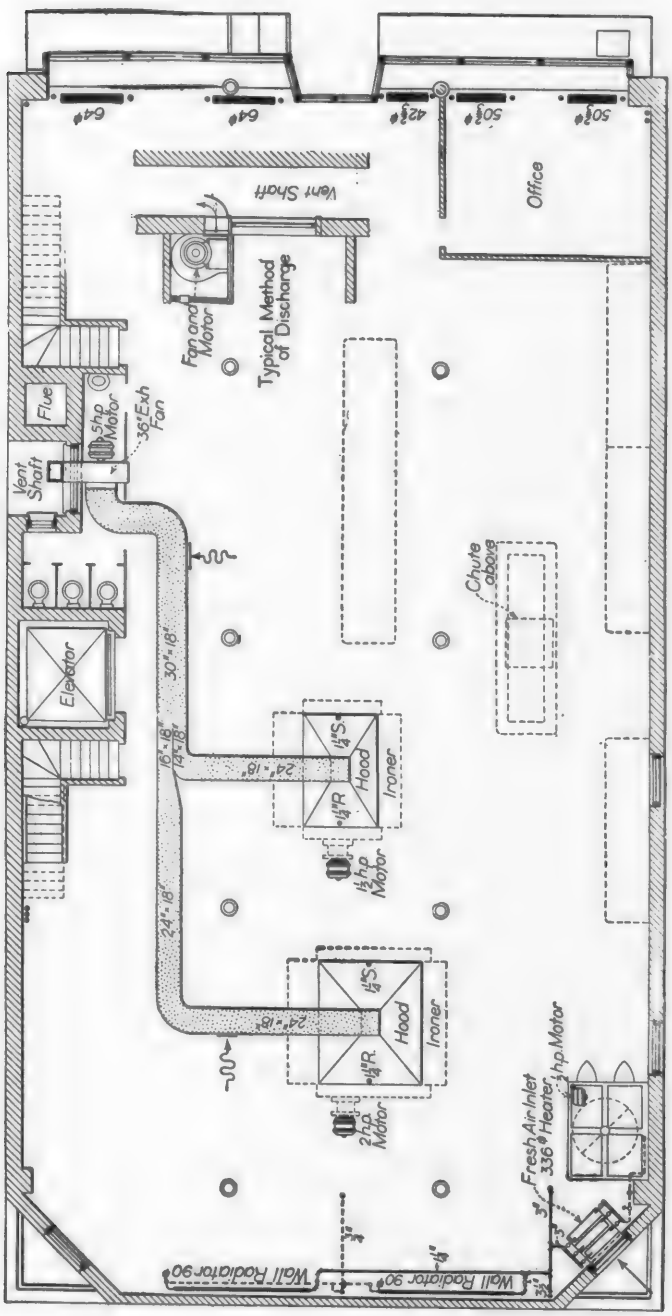
On December 4, 1911, with an outdoor temperature of 20° F., the average temperature on the first floor was 64° with a relative humidity of 47%; on the second floor the average temperature and relative humidity were 70° and 54% respectively.

On December 18, 1911, with an out-

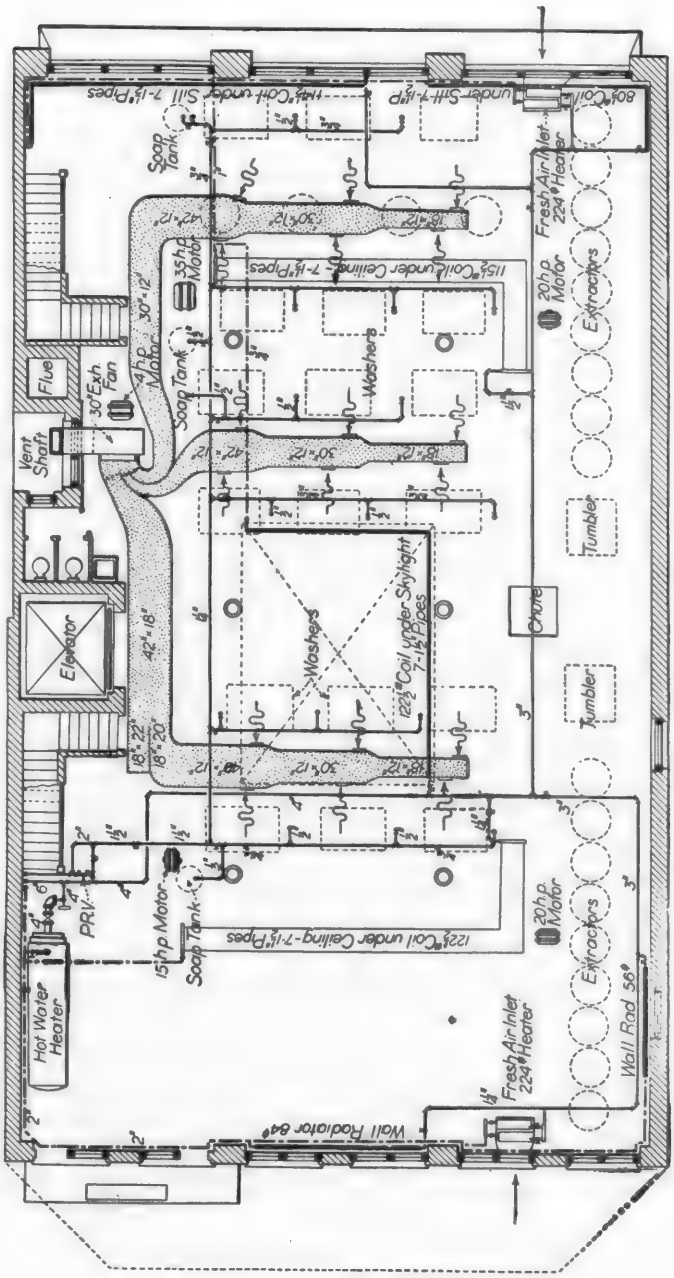
*Presented at the annual meeting of The American Society of Heating and Ventilating Engineers, New York, January 23-25, 1912.



MECHANICAL EQUIPMENT FOR A STEAM LAUND



FIRST FLOOR PLAN OF STEAM LAUNDRY, PROVIDED WITH EXHAUST VENTILATION

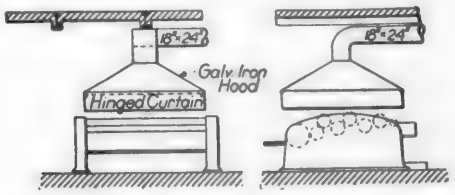


THIRD FLOOR PLAN OF STEAM LAUNDRY WHERE THE WASHING AND DRYING IS DONE

door temperature of 37°, the average temperature and relative humidity on the first floor were 68½° and 54% respectively; on the second floor 70° and 46%.

A vestibule was erected at the entrance door to first floor at a date after December 4, which accounts for the low temperatures on first floor on the date of December 4.

On January 22, 1912, on the top floor, where the washers and extractors are located with constantly rising vapor, open gutters full of water and entire floor wet, the average temperature was 64½°, the average humidity 74½%. On the second floor, average temperature 70°, aver-



ARRANGEMENT OF HOODS AND VENT DUCTS OVER MANGLES

age relative humidity 35%; on first floor average temperature 67½°, relative humidity 37½%. The outdoor temperature was 42° F.

During lunch hour, when the fans were not in operation, the temperature on the second floor rose to 75½° with a relative humidity of 24½%, and dropped again to the above condition after half hour's operation of the fan. It is the consensus of opinion of the owners and all those who visit the establishment, that it is the best ventilated laundry in the city of New York. The results obtained with the ventilating system are due to the fact that the rising steam and heat from the mangle cylinders are removed at the very source where they are generated, and fresh, tempered air is admitted at opposite ends of the lofts.

There are 40 girl workers on the first floor, 60 on the second, and 15 men on the top floor. The building has its own isolated power plant for the supply of steam, hot and cold water, current for light and power.

The plant occupies a part of the basement floor. It consists of two 200 H. P. water tube boilers, equipped with individual undergrate turbine blowers to assist the draft and enable No. 2 buckwheat coal to be burned. There are two high-speed direct-connected engine generators of 50 and 75 H. P. double voltage 230/115. The motors are operating on 230 volts, and the lighting on 115 volts, the average load being 50 H. P. It might be of interest to note that the traps of the mangles discharge into the exhaust and low pressure heating main, in which part of the high pressure condensation flashes into steam at the low temperature. The average pressure carried on the boiler is from 100 to 110 lbs. For the mangles and washers the pressure is reduced to about 75 to 80 lbs. I may add that for the five mangles and 20 washers a 4-in. main was provided, steam being reduced into same through a 2-in. Cash pressure reducing valve, and both the size of the main and that of the reducing valve have proven to be proper.

Difficulties in Connection with Warm Air Heating

Dr. W. A. Evans, in his talks on "How to Keep Well," published in the Chicago *Tribune*, mentions the following as objections that must be met in the operation of warm air furnace heating:

1. In many instances the foul air from the rooms is carried back to the furnace, heated and sent back into the rooms—recirculating, it is called.
2. The air at the inlets is too hot—from 100° to 130°, according to the atmospheric conditions.
3. It is too dry.
4. The gravity force is not strong enough to work in the teeth of a wind.
5. The heated air flows most readily in the vertical pipes and least readily in the horizontal pipes, therefore certain rooms are well heated and others poorly.

Some of these defects can be remedied. For instance, the reason for recirculating the air is to save heat. A more sanitary method would be to run the intake tubes within the outlet tubes, saving its heat but allowing its foulness to escape.

The humidity can be raised by placing pans on top of the furnace large enough to evaporate 5 to 10 gallons of water a day. It is not feasible to keep the windows continuously open where heating is with hot air. For this reason periodic blowing out of the rooms is absolutely necessary.

Elements of Design of Humidifiers and of Air Conditioning Apparatus

By Willis H. Carrier and Frank L. Busey

The accompanying article is part of an exhaustive discussion of air conditioning apparatus which was prepared by Willis H. Carrier and Frank L. Busey and delivered at the recent annual meeting of The American Society of Mechanical Engineers:

Air conditioning apparatus for controlling the humidity of air may be broadly classified, according to use, into humidifiers proper, which add moisture to the air in required amounts; and dehumidifiers, which remove a variable quantity of moisture from the air to reduce it to the required standard. The relative humidity of the air may also be altered, and in a measure regulated simply by changing its temperature without affecting its moisture contents.

Humidifiers may be classed into the spray and evaporative types, and the latter again divided into direct and indirect. The humidity of the air may also be increased by the direct introduction of steam into the air supply or into the room. Since the total heat of the vapor at atmospheric temperature is somewhat less than the total heat at steam temperature, this raises the temperature of the air perceptibly and is therefore intolerable in the majority of cases. Added objections to the direct use of steam are that it frequently gives a noticeable odor and that it is difficult to regulate. Its use is of so little engineering interest or value that it need not be considered here.

The spray and evaporative types of humidifiers have a distinct value aside from humidifying in their possession of a cooling effect which is in direct proportion to their moistening effect. The direct spray type of humidifier is distinguished from the evaporative type in that it introduces a finely divided or atomized spray directly into the room in constant volume, while the evaporative type introduces only the water vapor. There is also a mixed type which discharges both moist air and free moisture into the room.

In what may be termed the indirect evaporative humidifier the air is partly or entirely taken from the outside and is humidified and conditioned before it is introduced into the room. In the direct evaporative type the water vapor passes directly into the air of the room. The indirect system of air conditioning is also termed the central system.

A disadvantage of the direct spray type is that it always introduces a fixed quantity of moisture regardless of the needs or condition of the room until it is closed off by hand, or through a separate automatic control. In the evaporative type, on the contrary, there is an inherent self-regulating feature owing to the fact that the rate of evaporation is in direct proportion to the moisture deficit in the air. This is especially true in the indirect evaporative type, which, with all outside air, will maintain an absolutely uniform relative humidity, other conditions remaining constant.

Since the indirect evaporative type is capable of the greatest development and widest application, and therefore is of greatest engineering interest, this paper will be devoted largely to the theory of operation of this system and methods of its application.

(The authors here present types of the Carrier air purifier and humidifier adapted for use in the ventilation of auditoriums, offices and public buildings; of the indirect humidifier designed for industrial application and of the Carrier dehumidifier.)

DEWPOINT METHOD OF HUMIDITY CONTROL

Any one of the three spray types of air conditioners described are admirably adapted for humidity con-

trol by what is known as the dewpoint method. This system is applicable only where the absolute moisture content of the air in the room is unaffected to any great extent by extraneous sources of moisture supply or by moisture absorption. It depends upon supplying the enclosure with conditioned air having a definite dewpoint and maintaining a predetermined relationship between this dewpoint temperature and the room temperature. The dewpoint of the air supply is determined by saturating the air and removing all free moisture at the apparatus at a definite temperature. The dewpoint will evidently remain constant regardless of subsequent variations in air temperature. It may be shown that the percentage of relative humidity in an enclosure is dependent upon the difference between the dewpoint temperature and the room temperature and that it is substantially constant for any variation in room temperature so long as the difference between the dewpoint and room temperature is maintained constant (Tables 1 and 2).

It is evident that this system is particularly adapted to thermostatic control of (a) the dewpoint (saturation temperature at the apparatus) and the room temperature independently; (b) of the dewpoint with reference to a variable room temperature; or (c) of the room temperature with reference to a variable dewpoint temperature. System (a) is generally applied to air washers and humidifiers under winter conditions, where the outside temperature is considerably lower than the room temperature and to dehumidifiers where it is possible to maintain a definite dewpoint temperature throughout the entire year.

However, during summer conditions the saturation point at the apparatus will frequently and unavoidably be higher than the required minimum dewpoint. Under such variable temperature conditions it is necessary to control temperature with reference to the dewpoint according to system (c), and a humidifier is employed to give the air complete saturation under these conditions. One of the forms of differential thermostats (described by the authors) effects this control.

TABLE 1—DEWPOINT TEMPERATURE AND TEMPERATURE DIFFERENCES REQUIRED IN CARRIER SYSTEM OF HUMIDIFYING FOR VARIOUS PERCENTAGES OF HUMIDITY AND ROOM TEMPERATURES

Room Temperature Deg.	Percentage Relative Humidity																					
	35		40		45		50		55		60		65		70		75		80		85	
	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature
65																			58.8	6.2	60.5	4.5
70																			63.5	6.5	65.4	4.6
75																			68.25	6.75	70.1	4.9
80																			73.2	6.8	74.8	5.2
85																			78.0	7.0	79.75	5.25
90																			83.0	7.0	84.75	5.25
95																			87.8	7.2	89.7	5.3
65																	52.8	12.2	55.3	9.7	57.2	7.8
70																	57.5	12.5	60.0	10.0	61.9	8.1
75																	62.25	12.75	64.8	10.2	66.7	8.3
80																	67.2	12.8	69.4	10.6	71.2	8.8
85																	71.75	13.25	74.2	10.8	76.2	8.8
90																	76.7	13.3	78.8	11.2	80.9	9.1
95																	81.3	13.7	83.6	11.4	85.75	9.25
70																	54.75	10.25	59.6	10.4	64.3	10.75
75																	59.25	10.75	64.3	10.7	69.25	10.75
80																	64.1	10.9	69.4	10.6	74.1	10.9
85																	68.8	11.2	74.2	10.8	78.8	11.2
90																	73.4	11.6	79.0	11.0	83.6	11.4
95																	78.8	11.2	83.6	11.4	88.4	11.6
75																	50.75	8.25	55.4	8.4	58.3	8.7
80																	55.4	8.6	60.0	8.8	63.2	8.8
85																	60.0	9.0	64.8	9.2	68.2	8.8
90																	64.8	9.2	69.4	9.6	73.2	9.8
95																	69.4	9.6	74.2	9.8	78.0	9.8
80																	46.8	6.2	51.5	6.5	55.25	6.75
85																	51.5	6.5	56.2	6.8	60.0	7.0
90																	56.2	6.8	61.0	7.0	65.0	7.0
95																	61.0	7.0	65.8	7.2	70.0	7.2
85																	43.0	4.5	47.5	4.5	51.25	4.75
90																	47.5	4.5	52.0	4.8	56.0	5.0
95																	52.0	5.0	56.8	5.2	60.75	5.25
90																	38.0	3.5	42.5	3.5	46.25	3.75
95																	42.5	3.5	47.2	3.8	51.0	4.0
95																	33.0	2.5	37.5	2.5	41.25	2.75

Room Temperature Deg.	35		40		45		50		55		60		65		70		75		80		85	
	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature	Dewpoint Temperature	Difference Between Dewpoint and Room Temperature
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80																	67.2	12.8	69.4	10.6	71.2	8.8
85																	71.75	13.25	74.2	10.8	76.2	8.8
90																	76.7	13.3	78.8	11.2	80.9	9.1
95																	81.3	13.7	83.6	11.4	85.75	9.25
70																	54.75	10.25	59.6	10.4	64.3	10.75
75																	59.25	10.75	64.3	10.7	69.25	10.75
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75																	50.75	8.25	55.4	8.4	58.3	8.7
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90																	64.8	9.2	69.4	9.6	73.2	9.8
95																	69.4	9.6	74.2	9.8	78.0	9.8
80																	46.8	6.2	51.5	6.5	55.25	6.75
85																	51.5	6.5	56.2	6.8	60.0	7.0
90																	56.2	6.8	61.0	7.0	65.0	7.0
95																	61.0	7.0	65.8	7.2	70.0	7.2
85																	43.0	4.5	47.5	4.5	51.25	4.75
90																	47.5	4.5	52.0	4.8	56.0	5.0
95																	52.0	5.0	56.8	5.2	60.75	5.25
90																	38.0	3.5	42.5	3.5	46.25	3.75
95																	42.5	3.5	47.2	3.8	51.0	4.0
95																	33.0	2.5	37.5	2.5	41.25	2.75

(The authors describe at length various devices for securing automatic humidity control. In this connection attention is called to the fact that the difference between the dry and wet-bulb temperature for a given per cent. of humidity is not constant at different dry-bulb temperatures, *i. e.*, a constant difference maintained between dry and wet-bulb temperatures would not result in a constant per cent. of humidity during this change (Figs. 1 and 2). For instance, with 50 per cent. of humidity at a dry-bulb temperature of 70°, the wet-bulb temperature is 58.42°, a difference of 11.58°. At 80°, the wet-bulb temperature is 66.65°, or a difference of 13.35°. Thus it will be seen that the dry-bulb temperature has risen 10°, while the wet-bulb has risen but 8.23°, a difference of 1.77°.)

TABLE 2—HEAT REQUIRED TO CONDITION 1000 CU. FT. OF AIR (MEASURED AT 70° F.) FROM VARIOUS ENTERING WET-BULB TEMPERATURES TO VARIOUS DEWPOINT TEMPERATURES

Wet-Bulb Temperature of Entering Air	At 70 Deg. Fahr., 30 Per Cent Humidity, Dewpoint, 37.25 Deg. Fahr.			At 70 Deg. Fahr., 40 Per Cent Humidity, Dewpoint 44.5 Deg. Fahr.			At 70 Deg. Fahr. 50 Per Cent Humidity, Dewpoint 50.5 Deg. Fahr.		
	Sensible Heat	Latent Heat	Total Heat	Sensible Heat	Latent Heat	Total Heat	Sensible Heat	Latent Heat	Total Heat
−10	856	338	1194	981	471	1452	1086	567	1653
0	673	311	984	802	444	1246	907	540	1447
10	480	270	750	622	403	1025	730	498	1228
20	307	203	510	443	336	779	550	433	983
30	200	100	300	263	233	496	370	330	700
40				82	96	178	190	194	384

Wet-Bulb Temperature of Entering Air	At 70 Deg. Fahr., 60 Per Cent Humidity, Dewpoint 55.3 Deg. Fahr.			At 70 Deg. Fahr., 70 Per Cent Humidity, Dewpoint 59.6 Deg. Fahr.			At 70 Deg. Fahr., 80 Per Cent Humidity, Dewpoint 63.5 Deg. Fahr.		
	Sensible Heat	Latent Heat	Total Heat	Sensible Heat	Latent Heat	Total Heat	Sensible Heat	Latent Heat	Total Heat
−10	1161	699	1860	1243	801	2044	1310	935	2245
0	991	672	1663	1066	774	1840	1131	908	2039
10	814	631	1445	888	733	1621	955	867	1822
20	635	565	1200	710	667	1377	779	802	1581
30	457	463	920	532	565	1097	600	700	1300
40	276	327	603	353	430	783	423	564	987
50	83	137	220	154	240	394	244	375	619
60							63	118	181

ELEMENTS OF DESIGN

The degree of saturation of the air leaving any type of air washer depends upon the intimacy of the contact of the air and water, and upon the relation of the water temperature to the wet-bulb temperature of the entering air. It also depends to some degree upon the length of the spray chamber as well as upon the velocity of the air passing through it. With the centrifugal type of spray nozzles the water pressure is a most important element affecting the degree of saturation. Fig. 3 shows the humidifying effect secured with various velocities and at different pressures on the spray nozzle, in a standard humidifier having four 3.32 in. orifice centrifugal spray nozzles per sq. ft. These data were obtained from a test in which the wet-bulb depression of the entering air was maintained constant at 16°. It will be noted that an increase of 2½ lbs. per sq. in. in the spray pressure permitted a great-

ly increased velocity with perfect saturation, an effect which was undoubtedly due to the increased fineness of the spray rather than to the increase in the amount of water discharged. In this test, as in all standard humidifiers, the water was discharged in the direction opposite the air flow, which greatly increased the efficiency of saturation.

When the spray water is recirculated without heating, as in warm weather, it remains at all times substantially at the wet-bulb temperature of the entering air while the wet-bulb temperature of the air leaving the washer or humidifier is unchanged. Therefore it follows, in conformance with the theory, that when the air is completely saturated as in the humidifier the air is cooled to the wet-bulb temperature of the incoming air. This cooling effect is due to the transformation of sensible heat into latent heat of evaporation and is therefore in direct proportion to the moisture added to the air. The wet-bulb depression in atmospheric air averages from 12° to 15° in

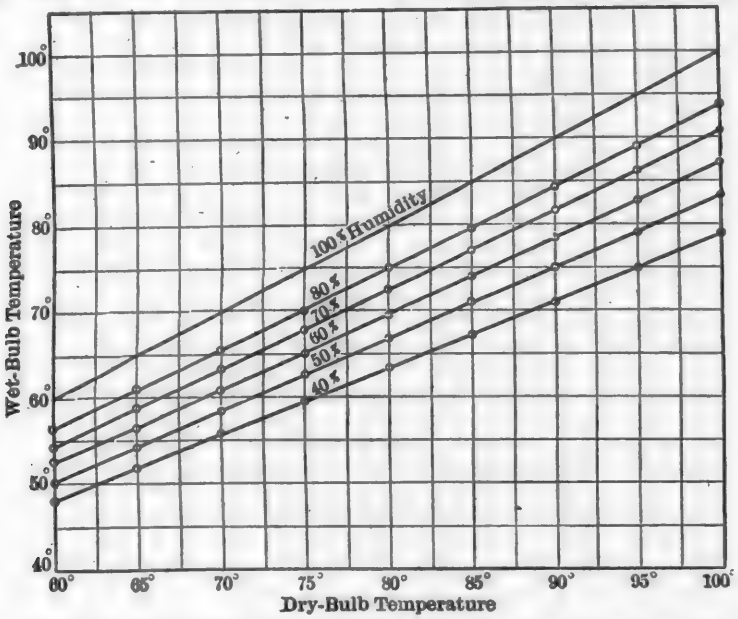


FIG. 1—RELATION BETWEEN WET AND DRY-BULB TEMPERATURE FOR DIFFERENT RELATIVE HUMIDITIES

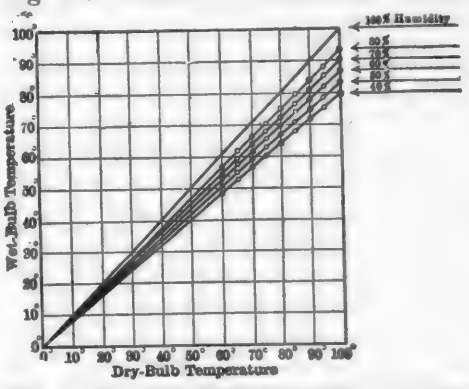


FIG. 2—RELATION BETWEEN WET AND DRY-BULB TEMPERATURE FOR DIFFERENT RELATIVE HUMIDITIES

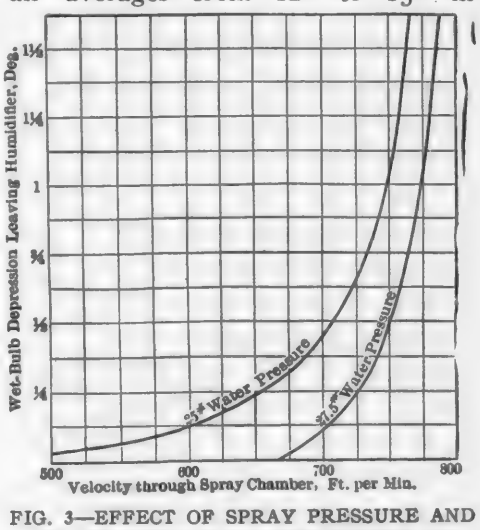

Wet-Bulb Depression Leaving Humidifier, Deg.
Velocity through Spray Chamber, Ft. per Min.
3# Water Pressure
7½# Water Pressure

FIG. 3—EFFECT OF SPRAY PRESSURE AND AIR VELOCITY UPON THE DEGREE OF SATURATION. INITIAL WET-BULB DEPRESSION EQUALS 16 F.

summer, while occasionally a depression of 20° to 30° is found in extremely hot and dry weather. In every case the humidifier will cool the incoming air a corresponding number of degrees.

When saturation is incomplete, as in the ordinary air washer, the wet-bulb depression of the air leaving the washer is found to be a constant percentage of the initial wet-bulb depression, when the air velocity remains constant.

POWER REQUIRED FOR OPERATING HUMIDIFIERS

Table 3 exhibits the power required to saturate 1000 cu. ft. of air per minute at various velocities. This is based on overcoming the resistance of the humidifier, using a fan with a static efficiency of 45 per cent., a fair value.

TABLE 3—RESISTANCE OF CARRIER HUMIDIFIERS AND HORSEPOWER REQUIRED TO HUMIDIFY 1000 CU. FT. OF AIR

Velocity through Spray Chamber in Ft. per Min.	Resistance in In. of Water	Resistance in Oz. per Sq. In.	Horsepower to Move 1000 Cu. Ft. Air per Min. At 45 Per Cent Fan Efficiency	Horsepower for Spray per 1000 Cu. Ft. of Air ($\frac{1}{16}$ Orifice Nozzle)	Total Horsepower Required per 1000 Cu. Ft. of Air
350	0.112	0.0647	0.0391	0.1408	0.1799
400	0.147	0.0850	0.0513	0.1231	0.1744
450	0.186	0.1075	0.0652	0.1095	0.1747
500	0.229	0.1322	0.0800	0.0985	0.1785
550	0.277	0.1600	0.0968	0.0897	0.1865
600	0.330	0.1906	0.1150	0.0822	0.1972
650	0.387	0.2240	0.1350	0.0758	0.2108
700	0.450	0.2600	0.1570	0.0704	0.2274
750	0.516	0.2990	0.1810	0.0658	0.2468

FORMULAE FOR COOLING EFFECT

It also follows that the cooling effect is a constant percentage of the initial wet-bulb depression. This may be expressed by the formulæ:

$$\frac{t_2 - t'}{t_1 - t'} = R \quad \ldots\ldots\ldots\ldots\ldots\ldots [1]$$

$$\frac{t_1 - t_2}{t_1 - t'} = 1 - R = E \quad \ldots\ldots\ldots\ldots [2]$$

where

t' = constant wet-bulb temperature.

t_1 = temperature of air entering washer.

t_2 = temperature of air leaving washer.

R = constant ratio depending upon intimacy of contact, air velocity, etc.

$1 - R = E$ = efficiency of saturation.

This does not include the power required to overcome the resistance of the ducts, which varies considerably, but which should not exceed that required for the humidifier. The resistance of the heating coils is not considered, because in summer, when the largest supply of air is usually required, the air is by-passed around the heaters, while in winter the requirements are so much smaller that the total horsepower is greatly reduced and the total resistance is but slightly increased.

The power required to pump the water is based on the use of centrifugal pumps giving 55 per cent. efficiency and using 1/16-in. orifice nozzles with rotary self-cleaning strainers.

RELATION OF COOLING EFFECT TO PERCENTAGE OF RELATIVE HUMIDITY

In the moist air system of humidifying it is evidently essential, as shown in Table 1, that the difference between the dewpoint temperature of the incoming air and the

room temperature shall not exceed a predetermined value, depending upon the percentage of humidity to be maintained. The minimum temperature at which air can be introduced is evidently the dewpoint or saturation temperature at the apparatus. This permissible temperature rise limits the possible cooling effect to be obtained from each cubic foot of air as shown in Table 4. This relationship is of primary importance in the design of the humidifying system and the disregard of it has been the chief cause of failure or of unsatisfactory operation.

In the majority of industrial applications the problem during warm weather, and in some instances throughout the entire year, is as much a question of cooling as of humidifying. Indeed, in the moist air system, as has just been shown, one is dependent on the other. In every industrial air-conditioning plant there are four sources of heat which must be taken into account in the design of the system:

TABLE 4—COOLING CAPACITY OF CARRIER HUMIDIFYING SYSTEM

Per Cent. Humidity in Room	Difference between Dewpoint and Room Temperature	Cu. Ft. of Air at 70 Deg. Fahr. Required per B.T.U. Cooling Effect
50	20.3	2.71
55	17.7	3.11
60	15.2	3.63
65	12.8	4.31
70	10.8	5.10
75	8.8	6.27
80	6.8	8.11

1. Radiation from the outside owing to the maintenance of a lower temperature inside. At ordinary humidities this is negligible, but at high humidities and in dehumidifying plants it is an important factor, owing to the increased temperature difference. This may be calculated from the usual constants of radiation.

2. The heating effect of direct sunlight. This is especially noticeable from window shades and exposed windows and skylights where the entire heat energy of the sunlight is admitted to the room, and from the roof which constitutes the greater amount of sunlight exposure and which in the ordinary construction transmits heat much more readily than the walls. Precautions should be taken where high humidities are desired to shade exposed windows and to insulate the roof thoroughly. Ventilators in the roof are of great advantage in removing the hot layer of air next it and those of ample capacity should always be provided.

3. The radiation of heat from the bodies of the operatives. This amounts to about 400 to 500 B. T. U. per operative, about one-half of which is sensible heat, the other half being transformed into latent heat through evaporation.

4. The heat developed by power consumed in driving the machinery and in the manufacturing processes in general. According to the laws of conservation of energy, all power used in manufacturing is ultimately converted entirely into its heat equivalent. Each horsepower of energy therefore creates 42½ B. T. U. of heat per minute which must be cared for by ventilation. In high-powered mills this is the chief source of heat-

TABLE 5—POSSIBLE ROOM TEMPERATURES OBTAINABLE IN CARRIER SYSTEM OF HUMIDIFYING, AT VARIOUS OUTSIDE WET-BULB TEMPERATURES AND VARIOUS PERCENTAGES OF HUMIDITY IN THE ROOM

Outside Wet-Bulb Temperature Deg. F.	Percentage Humidity in Room					
	55	60	65	70	75	80
50	67.0	64.3	62.0	59.8	57.7	56.0
55	72.0	69.6	67.5	65.2	63.1	61.1
60	77.5	74.9	72.5	70.4	68.3	66.3
65	82.8	80.2	77.6	75.6	73.5	71.6
70	87.2	85.6	83.1	80.0	78.7	76.7
75	93.7	90.8	87.3	85.9	83.9	81.9
80	99.1	96.2	93.4	91.2	89.0	87.0

ing and is frequently sufficient to overheat the building even in zero weather, thus requiring cooling by ventilation the year round.

RELATION OF ROOM TEMPERATURE TO OUTSIDE WET-BULB TEMPERATURE

During cool weather the dewpoint or saturation temperature at the apparatus is secured and controlled artificially at whatever point required. During warm weather, however, it is impossible during the greater part of the time to obtain as low a dewpoint as desired without refrigeration, which in the majority of cases of humidifying is impracticable. The lowest saturation temperature that can be obtained is the same as the outside wet-bulb temperature, as has been shown. Therefore, the dewpoint in the room will always be the same as the outside wet-bulb temperature. Since the difference between the dewpoint and the room temperature is dependent upon the percentage of relative humidity maintained, the minimum room temperature and the percentage of humidity required in the enclosure will be shown in Table 5. It will be noted that the higher the humidity carried the lower the room temperature may be kept.

Dust in Relation to Heating

By Konrad Meier

Readers of The Heating and Ventilating Magazine will recall the thoughtful and practical discussion by Konrad Meier of present heating methods, published in the issue for January, 1911, under the title of "What is the Matter with Modern Heating Practice?"

Mr. Meier has further amplified his views in a paper presented at the recent meeting of the heating engineers' society. Some of the more important points in addition to those contained in his previous article, are given herewith:

It is a popular notion that steam and hot water systems give a different sort of heat. Engineers would define this more correctly by stating that various methods of heating will produce different air conditions. The old-fashioned devices are still considered by many people to be more wholesome, even though less efficient than the modern apparatus, of which it is often said that it does not ventilate, the dead air and stuffiness being attributed generally to the lack of air supply incidental to heating. Partly out of this idea has grown the popularity of the indirect system, but now complaints are heard, that through heating, and even tempering, by stacks, the air will lose its natural sweetness and refreshing qualities. The recent tendency to oppose plenum ventilation on the part of the medical profession appears to be the result of such observations.

Engineers themselves will have observed, especially in public buildings and schools, that even a generous plenum supply will not always make the occupants forget the desire to open the windows. Heated but unoccupied rooms are often found stuffy, even after long vacancy, when a slight amount of natural ventilation should suffice to keep them sweet. Everybody has noticed the stifling air of ill-kept empty railroad coaches which is not altogether caused by overheating, nor by previous occupancy. In such cases the foulness of the air cannot be due to lack of ventilation alone.

These circumstances would indicate a cause of vitiation aside from the well-known sources and explains in a measure the demand for purer air which has really arisen and become general only with the introduction of the modern ways of heating.

None of this evidence is proof that the heating apparatus itself is at fault, but it should certainly raise the

question whether the quality of room air is altered in any material way by the process of heating. Changes in temperature and relative humidity even though they bear on comfort to an extent would not account for it, since we know they do not in themselves affect the sweetness of the air at least within the wide range between a brisk, dry, cold, northwest, and the moist, warm, ocean breezes in summer.

If it be found that the air is undergoing chemical, physical, biological or only purely thermal changes through any of the prevailing methods of heating, we will then have to answer the next question, whether such changes may be considered as deterioration and are of any consequence, in general, or only in particular cases. When the causes and effect are determined, we will be able to prescribe the remedy.

CAUSES OF VITIATION

As proof of certain chemical changes we have the investigations of Professors v. Esmarch and Nussbaum. The former authority has demonstrated the following points:

Dust, especially when of organic nature, will decompose on heating surfaces from a temperature of about 160° F. upwards. Of the gases produced, ammonia is shown by chemical reaction, not only over the radiator, but in the room air at large. The quantities are too small to be called a poison to the average person, but are quite often noticeable by odor. Under extreme conditions, when steam is turned into a dusty radiator or stack, the ammonia may become very disagreeable. Analysis was made for CO, but none could be found.

When heating surfaces were carefully cleaned before the test, the effect on the air was still present and demonstrable by analysis, but less intense, thus showing that the dust suspended in the air will also decompose when passing over the heating surfaces, and that there is a constant vitiation going on beside the periodical effect taking place while reheating. No traces of any foreign gases could be detected until steam was turned on, hence we are safe in saying that heating is the cause. We may conclude also, that if heating were accomplished by clean surfaces and without causing air circulation, decomposition could not take place.

Prof. Nussbaum, investigating independently, has arrived at the same general conclusions, but has gone further into certain details. He found that moist organic dust will begin to decompose even at 140° F. while dry dust, or dust in dry air, must be heated to about 200° F. before gases become noticeable. The same applies to dust lying on surfaces or passing by them.

Various kinds of dust were subjected to the tests. Inorganic matter was found to produce the least odor and practically no gas, while ordinary house dust, as it enters into rooms from the streets, with the air or by way of shoes and clothing, produces most of the ammonia. This is explained by the large percentage of animal excreta which ordinary street and house dust contains particularly in cities with non-absorbent pavements.

OZONE WILL NOT GET PAST RADIATOR OR STACK

Another indication of chemical reaction was furnished unwittingly, incidental to certain tests of ozonizing apparatus. It appeared, that the output of ozone was always reduced when the air was allowed to pass the electrodes slowly and to become heated thereby. The tendency of the ozone to combine with organic matter increases with temperature. Hence a good portion of the output was always absorbed even while the air to be ozonized was passing the generator. When slowing down the air current and raising its temperature, a point was reached at which no more ozone could be found in the air issuing from the apparatus. The temperature rise in such devices is much smaller than is usually the case with heating. Furthermore the surfaces for heating are much larger and less apt to be

clean. We are safe in assuming that no ozone will ever get past a radiator or stack. It is most probable, that a certain amount of oxygen is also sacrificed by the process of heating, but the extent of this has not been established. In any event, the absorption of ozone, which may be said to be the sweeping, purifying element would account in a measure for the lifeless quality of air issuing from a register or ascending from a radiator.

To prove certain physical changes in room air, it is only necessary to recall the long established facts, that fog and cloudiness are largely caused by dust and soot and that the relative humidity, at which condensation becomes visible, is much dependent on the purity of the air. This shows that moisture has a distinct tendency to cling to dust and weight it down, more or less, according to atmospheric conditions.

There is no doubt, however, that this moisture is evaporated when dust is being heated. It is lightened thereby and all the more easily joins the current of warm air rising from a heater. The continuous air circulation incidental to heating keeps a certain amount of dust in motion, which would otherwise settle down, and will therefore add certain elements to the air we breathe.

As proof of this we need to call attention only to the visible tracks left by the dust, on walls above radiators which are sometimes deflected by shields, but should be prevented in other ways. It is by no means likely that live organisms are destroyed to any extent by the ordinary forms of heating apparatus. This depends on higher air temperatures or on steam itself. Furnaces, except in red-hot condition, which is undesirable in other ways, and radiators, therefore, cannot be considered as sterilizers. They merely dry the dust, stir it up and keep it in motion while the heat is on. Considering this, we are forced to admit, that heating increases the bacterial contents of the air.

EFFECT OF VITIATION BY HEATING

The elimination of the ozone and whatever loss of oxygen may occur, probably have no distinct and traceable effect on health. They represent the general drawback of indoor life, not serious in itself, probably because we have long since become inured to it. The situation is different in regard to the contamination of the air by fine, dried dust, which has become general more recently, through prevailing methods of heating. This may be clear if we remember, that the old-fashioned tile oven, the ordinary free standing, well-polished iron stove, or the open fireplace depend on their effect largely on radiation, and that the heating surfaces are readily accessible and apt to be clean. This cannot be said of the hot-air furnace, nor of indirect stacks, nor of certain styles of radiators, and least of all of the screened direct surfaces.

While the public may have become indifferent to the immediate sensible effect of dust contamination, because it is so general, it is nevertheless a real nuisance. The prevalence of chronic ailments of nose and throat would indicate that we are not immune to it. It is one of those elements which have eluded the ordinary air tests made with the idea of determining the need of ventilation, and did not exist to any extent at Pettenkofer's time, when the carbonic acid test was recommended. Naturally, it would not show in this sort of test. Nor would a bacterial test be fair, since the dried particles are not so apt to settle down on the surfaces prepared for them as ordinary, unheated dust would do.

If the lessons to be drawn from the campaign against tuberculosis and modern hygiene in general are of any value, we must admit that this flying dust is most undesirable.

As to the bearing of the purely thermal quality of the air, we can only judge by general experience. It is true, overheating has been shown by Fluegge to cause a distinct lowering of vitality. The question is

not really one of overheating in this case, but whether radiant heat with comparatively low air temperature, or higher air temperature without heat rays, are more conducive to comfort and health, and whether the latter tendency produces effects similar to overheating.

Aside from the direct bearing of the hot-air currents on the dust, we have to consider the lower relative humidity of hotter air and its greater drying effect on persons as well as on dust and other objects, caused partly by the air in transit, and in the neighborhood of the register. All things considered, there would seem to be no question that the excessive dryness which is often complained of in heated rooms is materially increased by those methods of heating depending on air as the heat carrier, and is made more irritating by the attendant increase of dustiness.

There is also the general observation that cool air is breathed in more freely. This may be partly due to the feeling that it is more inviting, or the subconsciousness that it is more refreshing. We are certainly more apt to take a deep breath of fresh, sweet air than of tainted, stuffy air. Again, there is also the purely physical condition of its smaller volume for the same amount of oxygen, causing less labor in respiration, even though its final temperature may be the same. Most persons have more difficulty in getting their breath in hot air than they do in cold air.

If there is anything in the theory that free air circulation around each person is a most desirable element in creating comfort, regulating the thermal formations of the body and conserving health, cooler air surrounding a body would seem to be more likely to induce this in the natural way by temperature difference, than warmer air would do. The currents created by a hot-air heating system generally do not take place where such circulation might be wanted. Hot-air heating therefore would tend to reduce the convection of heat from the body which Fluegge claims to be a necessary function.

MEANS TO PREVENT VITIATION OF AIR BY HEATING

Naturally, the foremost remedy that suggests itself is to exclude the dust, as the main source of vitiation. We all agree this would be desirable, but unfortunately it cannot always be done. Even where artificial devices for this purpose are used in connection with warm air heating and air supply systems more or less dust will enter into a building in other ways. Vacuum cleaners and general vigilance will help, but the fact remains, that in a great majority of cases we will have to contend with more or less dust, and must proceed on this assumption.

FAVORS MODERATE TEMPERATURE OF HEATING SURFACES

The safest way to prevent the chemical adulteration of air through decomposing of organic matter would appear to be a moderate temperature of heating surfaces. With clean surfaces and dry air, according to V. Esmarch and Nussbaum, there will be no vitiation with temperatures up to 160° F., and none to speak of until the surfaces are near the boiling point. Under less ideal conditions, where more or less dust is to be expected, the temperature should be kept down to about 160° F. or lower, as a rule, excepting an occasional rise to 180° F. during a cold spell as unavoidable and of minor importance.

Moderate temperature of heating surface seems also advantageous in view of the devitalizing of the air by the absorption of all the ozone and probably of part of the oxygen.

To avoid the contamination of room air by dust, whether in dried, decomposed, or normal condition, it would seem advisable again to heat at low tension, which means liberal surfaces at relatively low temperature. Low and shallow styles of radiation depending the least upon convection, are also indicated. Even with equal air volumes in circula-

tion, the movement will be less concentrated, less intense, and less apt to pick up dust. It may be well to distinguish and repeat that air circulation created by heating is not the kind which is useful from a ventilating point of view. No matter what may be our final judgment in regard to secondary circulation, or the desirability of a certain movement of air around the bodies, it should still be our endeavor to prevent or distribute as far as possible, all sensible air currents by heating. They are likely to be either too hot or too cold for comfort and not apt to occur where they might be needed.

ADVANTAGES OF HOT-WATER HEATING

Hot-water heating would seem to meet the situation best in respect to temperature and liberal surfaces, but whichever system is used, it is advantageous to reduce the tendency to create air currents and to give preference to the kind of surface that is yielding a greater ratio of its heat by radiance. Low and flat radiation which is recommended is generally no more expensive considering its higher total efficiency.

The next important rule should be to insist on clean heating surfaces. It will not do to rely for this on the good intentions of any one concerned. Engineers must take the first step to induce or compel clean surfaces by selection of the most easily cleanable styles and by proper disposition to keep the greatest possible part of it in view. As it happens, the styles which are giving the best radiant heat and the least air current are also the easiest to clean. Radiators should have fair spacing between loops to show the dirt and to make it likely that it will be removed. They should not be tucked away in corners. Better means are always at hand to make them inconspicuous or presentable, as the case may require. Enamel finish in some neutral color, black or white, is only one of those means, which, by the way, will help appreciably in the radiating efficiency. This sort of finish, it is sometimes complained, would show the dust. It is all the more desirable then, in order to induce clean surfaces.

OTHER UNSANITARY PRACTICES

There are a number of other practices, which in the light of the foregoing should be classed as unsanitary.

It is unsanitary to place heating surfaces overhead, where the dust is not seen and rarely removed, except by air currents.

It is unsanitary to run pipe connections to radiators in a roundabout, fussy way that will make dirt corners.

It is unsanitary to use floor registers for heating under any circumstances.

Similar features and practices that may appear questionable from these viewpoints may be tolerable under some conditions, but objectionable in other places. One should use judgment and discretion in this respect. In hospitals, for instance, a stricter standard should prevail, also in public buildings where the service and maintenance are not of the best.

ENAMELED RADIATORS ADVOCATED

For years we have enjoyed clean plumbing fixtures, designed on hygienic lines, and we have insisted on cleanliness in many other ways, if only on general principles. There is every reason why we should insist on the same qualities in heating equipment, which is now nearly always on a decidedly lower plane in this respect than other apparatus in one and the same building. Enameled radiation would be produced, if there were a serious demand, while the better styles of radiation are true and good in design, they are usually false and cheap-looking as to finish. The best finish enamel is the most sanitary, and in its turn would encourage proper self-assertive disposition in place of the unfortunate habit of hiding. Substantial appearance and neatness in details will also help in this direction.

If it be conceded, that cooler air, combined with mild radiant heat is

the desirable, pleasant atmospheric condition to be reproduced indoors by artificial heating, we come again to the same conclusion in regard to the methods. Flat, low, widely-spaced direct radiation at moderate temperatures would evidently give the nearest approach to it, when combined with whatever ventilation that may be desired, by direct leakage by windows, or by a clean, evenly and low tempered air supply system. In direct or hot-air heating should be used only where the heat requirement is comparatively small, that is, in substantial buildings and in rooms with moderate exposure, for which the incoming air for heating need not be much above room temperature. In exposed buildings of light or permeable construction hot-air heating in any form is not only uncertain, inefficient and undesirable on account of the dust pollution, but it will involve high air temperature with colder walls, lower relative humidity, especially as a structure becomes dry under the active ventilation. Again, in massive structures, with little exposure, there may be good reasons for some artificial air supply, while natural leakage is often all that is necessary in buildings requiring much heat.

Considering, that the requirements for heat and for ventilation generally are not all coincident, and that a purer, more effective and wholesome air supply can be secured by windows or other rational means, when and where required, and without affecting the heat supply, and considering that direct heating induces direct leakage from outdoors while the indirect system admits the air through musty passages and spoils its freshness, it would seem that the idea of better sanitary conditions through heating by air is largely a delusion. The indirect method should be restricted to cases where it is really indicated, or, if no other system will do, the conditions might be made more favorable for it by extra-protection. In any event, such apparatus should be designed to avoid excessive air temperature, equipped with filters to keep the dust out of air passages and heating stacks, and with all provisions to induce proper maintenance.

In so far as excessive dryness in itself, as caused by heating, may be undesirable and unwholesome, it is pertinent to consider also the best means to overcome these extremes. As previously pointed out the method of heating in itself makes an appreciable difference and would seem to be the natural remedy, under ordinary conditions and for new apparatus. To relieve an old plant it may be necessary, sometimes to use artificial moistening, but when doing so it should be borne in mind, that moistening without taking care of the dust is liable to increase discomfort through the increased decomposition of organic matter. The rule should be to moisten only when the air supply can be filtered or washed.

The excessive dryness complained of sometimes with direct steam heat is often nothing but irritation of the respiratory tract through dust. It should be relieved in such cases by cleaner radiation and cleaner surroundings, and by lower temperature of heating surfaces. Moistening pans will raise humidity, but generally do not improve the air while dust and dirt are present, owing to the increased tendency for decomposition.

The tempering surfaces should be arranged to secure a swift passage for the air and designed also with the idea of making them self-cleaning, and to reduce the chance of drying and decomposing dust in transit. Present styles of tempering stacks and coils are by no means ideal in this respect. They could be improved considerably in the direction of higher velocities and heating efficiency without necessarily increasing resistance.

These would seem to be sufficient reasons for reform, and the lines on which to improve heating apparatus from the sanitary point of view do not seem difficult to follow and would lead, if anything toward greater effi-

ciency in other directions. Nor should there be much difference in cost, when taken as a whole. Hot water heating, for instance, can be brought down in most cases very nearly to the cost of steam, if scientifically planned, and the practical possibilities of its adaptation to all sorts of conditions are by no means exhausted. It is very well suited for utilizing waste heat from all sorts of motors. The ways and means for reform to go more into detail would raise too many questions, but in general, all those suggested may therefore be said to be within our reach.

Briefly resuming we may put down the following rules, which may serve also as a guide in the event of a discussion:

1. To prevent chemical vitiation of room air by heating it is desirable to have surfaces at moderate temperature, if possible not exceeding 180° F. at any time and to use easily accessible and clean radiation. Air supply should be filtered where necessary.

2. To prevent the physical admixture of dust and its drying, caused by the air currents due to heating, it is desirable again to use heating surfaces at moderate temperature, well distributed, spread out and inducing salubrity in general.

3. To reduce the pollution of the air by the bacteria the same means are indicated as those recommended to keep down the dust.

4. To produce thermal conditions most agreeable and wholesome to a majority, it seems desirable to favor the application of radiant heat which warms the surroundings and occupants directly and produces comfort at lower air temperature. It should be used in a mild form and be well distributed. Ventilation should be treated separately. Each problem can be solved by itself to the best advantage.

5. To prevent excessive dryness, the same idea of keeping down air temperature by utilizing heat rays seems indicated.

6. Ventilating apparatus should be made self-cleaning throughout.

Thermal Chart

By Burt S. Harrison

(*See Pages* 34-35 *for Chart*)

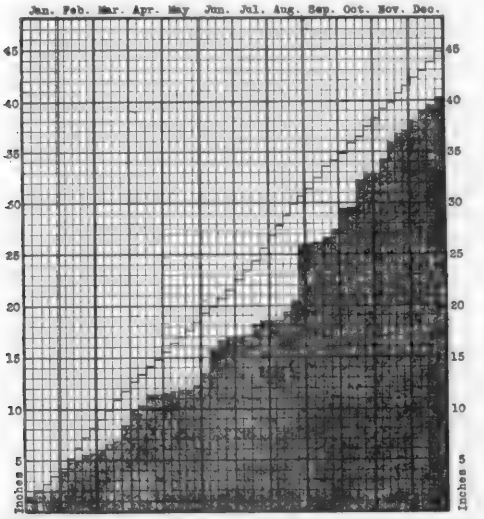
In a fan system of heating air, the thermal load of the system depends upon the volume of air entering the heater, the temperature of the air as it enters the heater and the ultimate temperaure as it leaves the heater. In figuring this thermal load then, the value of a B. T. U. must be taken as the value at the temperature of the air entering the heater.

It is not always convenient to measure the volume of the air in the system at that point. In some cases it is more convenient to measure the volume leaving the heater casing, or to measure it at the register faces in the rooms. In such cases the B. T. U. value used in the figuring must be corrected for change in temperature, or else the volume of air readings must be corrected for temperature rise.

The writer submits herewith a chart which may be readily used, showing at a glance the B. T. U. values at any temperature within the range of heating and drying work. By the use of this chart, one may tell quickly what B. T. U. value to use in his computations, whether his anemometer readings of air volume be taken at the air inlet to the fan, in the heater case, or at the register outlets. The note of procedure at the top of the chart fully explains the operation.

New York City Weather Records

The record of the weather in New York City, for 1911, with comparative data, has been compiled in tabulated form and published by the local office of the United States Weather Bureau. Ac-



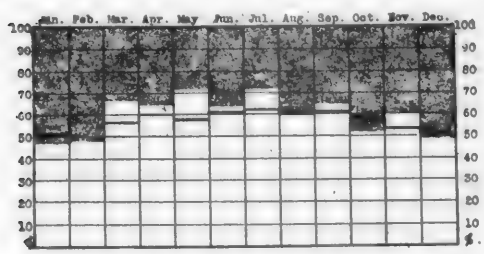
PRECIPITATION IN NEW YORK CITY DURING 1911

Shaded columns, accumulated depth in inches.
Black line, the normal.

companying the tables are some interesting charts by which some of the more important weather conditions that obtained during the year may be seen at a glance.

For instance, in Fig. 1 is shown the precipitation for the year, the shaded columns giving the accumulated depth in inches by weeks, and the heavy, broken line, the normal. It will be seen that the total precipitation for 1911 was 40.34 in., as compared with a normal of 44.63 in.

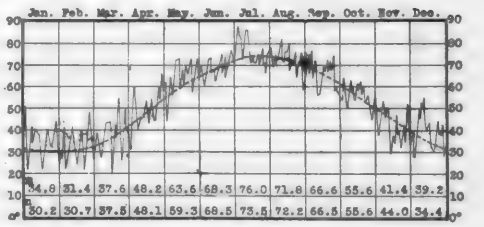
The sunshine chart, Fig. 2, shows the unusual amount of sunshine that New York was favored with during the past year, the figures showing 60% of sunshine as compared with a normal of 58%. The figures are an interesting commentary on the statement sometimes made that, as a rule, there is more cloudiness



SUNSHINE IN NEW YORK CITY DURING 1911

Unshaded Columns, Per Cent. of Possible, by Months.

Heavy Line, Normal for Period of 17 Years.



TEMPERATURE IN NEW YORK CITY DURING 1911

Black Line, General Fluctuations of Daily Mean Temperature.

Broken Line, Annual Curve of Normal Temperature.

than sunshine in New York. The fluctuations of the daily mean temperature for the year is shown in Fig. 3. The dotted line shows the annual curve of normal temperature.

How the Romans Heated Their Houses

The accompanying illustration is going the rounds of the daily press and is intended to demonstrate the methods used by the Romans 2,000 years ago in heating their buildings, as gathered from an inspection of extensive Roman remains recently discovered at Great

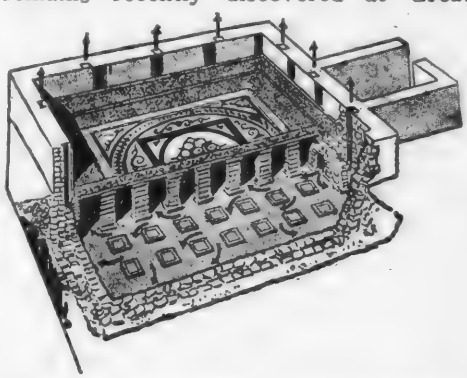
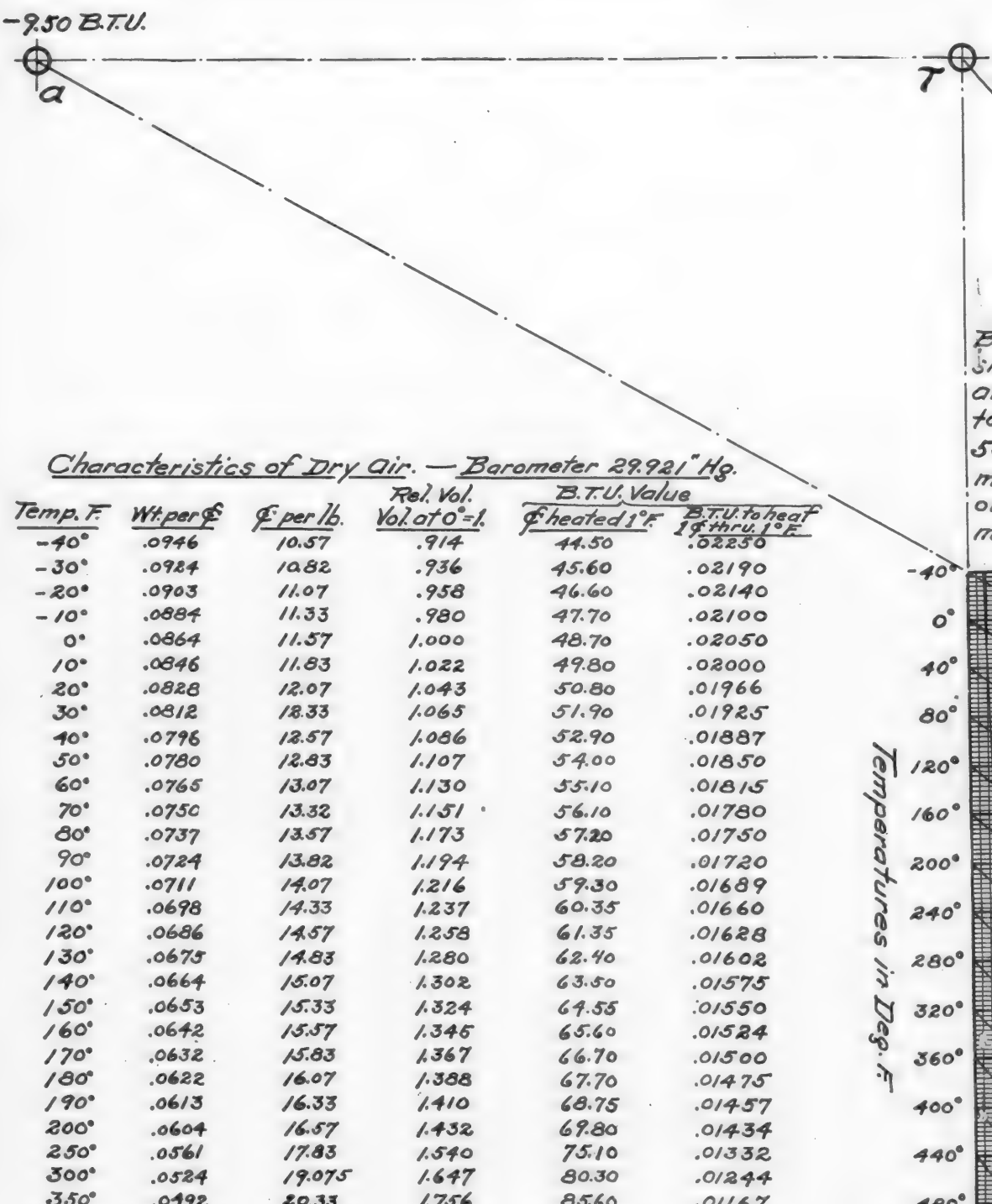


DIAGRAM OF HEATING ARRANGEMENTS IN ANCIENT ROMAN HOUSE

Chesters, on the Tyne, in England. The house illustrated is supposed to be that of a Roman military commander. It is thought that the heating was done by means of a fire in an adjoining chamber, shown at the right, and that the products of combustion were admitted to a space beneath the main floor and passed up through flues in the side walls to the roof. As the construction was entirely of incombustible material, the danger of the building's burning was eliminated. It is known that the Romans were more or less familiar with hot water heating by means of coils located in the walls. By either that method or by heating the floor and walls directly, as is the case in question, satisfactory results could undoubtedly be obtained in a climate that was not especially severe.



Characteristics of Dry Air. — Barometer 29.921" Hg.

Temp. F.	Wt. per ℄	℄ per lb.	Rel. Vol. Vol. at 0° = 1.	B.T.U. Value ℄ heated 1° F.	B.T.U. to heat 1 ℄ thru 1° F.
-40°	.0946	10.57	.914	44.50	.02250
-30°	.0924	10.82	.936	45.60	.02190
-20°	.0903	11.07	.958	46.60	.02140
-10°	.0884	11.33	.980	47.70	.02100
0°	.0864	11.57	1.000	48.70	.02050
10°	.0846	11.83	1.022	49.80	.02000
20°	.0828	12.07	1.043	50.80	.01966
30°	.0812	12.33	1.065	51.90	.01925
40°	.0796	12.57	1.086	52.90	.01887
50°	.0780	12.83	1.107	54.00	.01850
60°	.0765	13.07	1.130	55.10	.01815
70°	.0750	13.32	1.151	56.10	.01780
80°	.0737	13.57	1.173	57.20	.01750
90°	.0724	13.82	1.194	58.20	.01720
100°	.0711	14.07	1.216	59.30	.01689
110°	.0698	14.33	1.237	60.35	.01660
120°	.0686	14.57	1.258	61.35	.01628
130°	.0675	14.83	1.280	62.40	.01602
140°	.0664	15.07	1.302	63.50	.01575
150°	.0653	15.33	1.324	64.55	.01550
160°	.0642	15.57	1.345	65.60	.01524
170°	.0632	15.83	1.367	66.70	.01500
180°	.0622	16.07	1.388	67.70	.01475
190°	.0613	16.33	1.410	68.75	.01457
200°	.0604	16.57	1.432	69.80	.01434
250°	.0561	17.83	1.540	75.10	.01332
300°	.0524	19.075	1.647	80.30	.01244
350°	.0492	20.33	1.756	85.60	.01167
400°	.0464	21.57	1.863	90.90	.01102
450°	.0438	22.83	1.972	96.10	.01040
500°	.0416	24.07	2.080	101.30	.00987

B. T. U. REQUIRED TO HEAT AIR WHEN VOLUME IS

Absolute Zero.
-463°F.

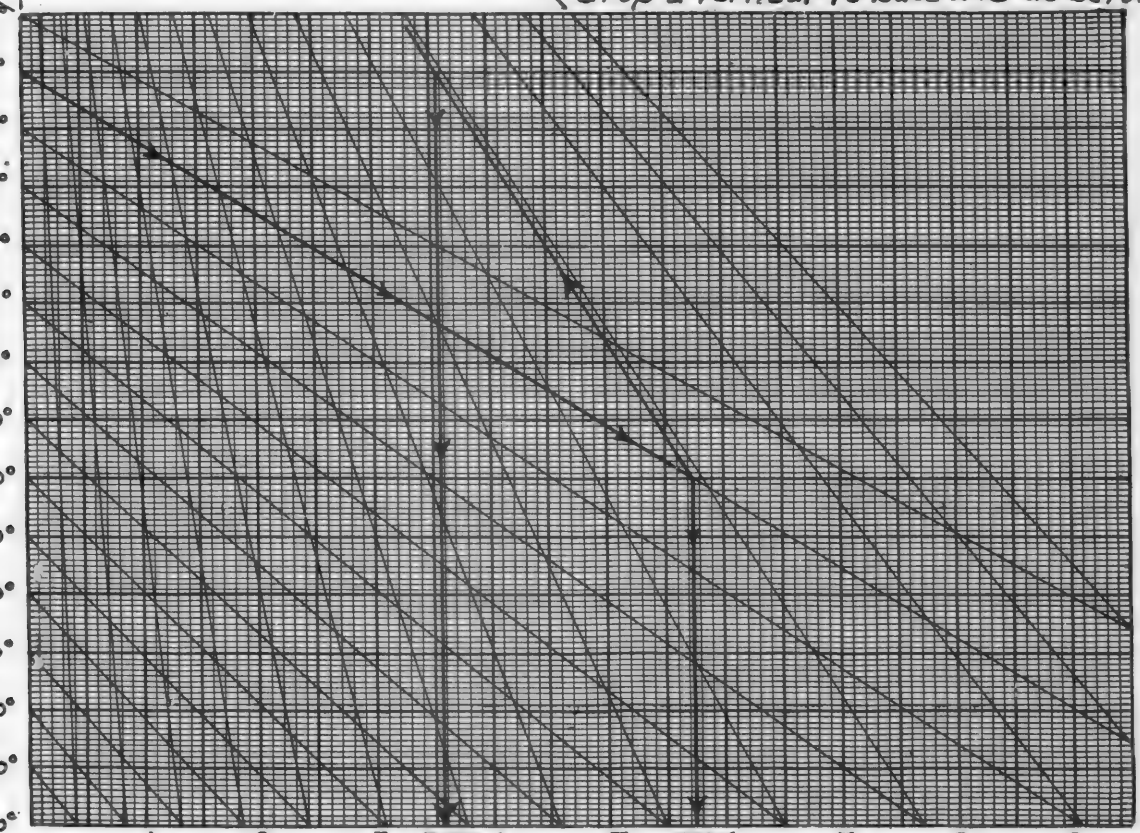
THERMAL CHART

B. S. Harrison — New York Dec. 16-11.

Problem: One cu. ft. of air heated from 0°F. to 280°F. will require how many B.T.U., when volume is measured at initial Temperature? Measured at final Temperature?

Procedure: Find initial temp. of air at left edge of chart. Follow Radial Line from Centre "C", passing thru 0° until it intercepts the horizontal Line representing final Temp. of 280°. From this intersection drop a vertical to base Line and read on that Scale the resultant B.T.U. if volume of air is measured at initial Temperature. If volume of air is to be measured at final Temp., instead of dropping from the 280° intersection, follow back on radial from centre "T" to horizontal 0° Line, then drop a vertical to base line as before.

By Chart as shown, one Cu. ft. air heated from 0°F to 280°F. will require 5.74 B.T.U. if volume be measured at initial Temp. or 3.58 B.T.U. if volume be measured at final Temp.



1. 2. 3. 3.58 4. 5. 5.74 6. 7. 8. 9.

lume measured at Final Temp. → ← Volume measured at Initial Temp.

B.T.U. per Cu. Ft. of Air.

E IS MEASURED AT INITIAL OR AT FINAL TEMPERATURE

THE HEATING AND VENTILATING MAGAZINE

Vol. 9 March, 1912 No. 3

PUBLISHED MONTHLY AT
1123 BROADWAY, NEW YORK
BY THE
Heating and Ventilating Magazine Co.
President A. S. ARMAGNAC
Secretary and Treasurer, G. PETERSEN
The address of the officers is the address of this magazine.

A. S. ARMAGNAC, Editor
G. PETERSEN, Advertising Manager

Chicago Representative
W. A. WADSWORTH, 1502 Tribune Building.

European Representative:
AMERICAN PUBLICATION BUREAU, 304, High Holborn, London, W. C.

Subscription,	$1.00 per year
Foreign countries,	1.50 " "
Back numbers,	15 cents a copy

TWO events of more than ordinary importance have given an auspicious opening to the new year. One of these is the newly-published Federal system of warm air furnace heating and ventilation, promulgated by the Federal Furnace League. This system, it is confidently expected, will go far to place on a scientific basis the design and installation of furnace heating plants. The other event is the establishment of the first municipal bureau of ventilation in Chicago with provisions for a ventilation inspector in charge and four ventilation inspectors. Inasmuch as the new ventilation ordinance in Chicago, which became effective January 9 last, covers, not only the usual classes of buildings, but also buildings used for the sale, storage or manufacture of merchandise, theatres, club houses, etc., it is apparent that Chicago has in prospect the most thoroughgoing regulation of the quality of its air supply that has ever been attempted. But what is more important, it has established a precedent which, it is safe to say, will be followed sooner or later in all of our more progressive cities. The event thus becomes one of far-reaching significance, as beginning an enlargement of the industry to almost limitless dimensions.

HOW long does it take to heat a building from a given outside temperature to 70° F.? This question is one that frequently arises in the work of the heating engineer, but, so far as we know, he will look in vain for any published data on the subject. In a recent case of a medium-sized school building, the estimates ran from 5 to 8 hours. But there were no empirical data to work from. An inquiry among other engineers who would be likely to have this information developed the fact that they were equally anxious to procure the desired figures. In practice it is quite the customary thing to add a certain percentage to the estimated capacity of a heating plant, but just why this is necessary does not occur to most engineers. Yet it is obvious that the heating of a cold building is a far different proposition from maintaining a 70° F. indoor temperature, even in zero weather. The problem presents some nice calculations, for the wall temperatures, especially those of the outside walls, in addition to their capacity for transmitting heat, have to be taken into consideration. Yet the entire thickness of an outside wall does not figure, for the exterior, of course, is practically at the temperature of the outside air. We should be glad to hear from any of our readers who have made tests in this connection or who have any data bearing on the subject.

MECHANICAL EQUIPMENT

The Art of Vacuum Cleaning

I.

A PRACTICAL DISCUSSION OF PRESENT METHODS AND APPLIANCES

By Austin H. Hart

Vacuum cleaning is the name applied to the process of removing dust and dirt from rugs, carpets, floors, furniture, walls and other fixtures and furnishings throughout a building and conveying said dust and dirt to a suitable receptacle.

This method of cleaning has been in use for a number of years and it has of late, by improved appliances, been brought to high perfection. It will only be a short time before the installation of a stationary cleaning vacuum system will be as essential to the equipment of a modern building as the heating, ventilation and plumbing.

We shall confine this treatise to the stationary system as, we believe, satisfactory results in cleaning cannot be expected from the portable machines, power and exhauster displacement being necessarily sacrificed to lightness, with the further and most serious objection that the portable cleaners employ a very unsanitary method of collecting more or less of the bacteria from rugs, carpets and furnishings, and discharging the same back into the atmosphere of the room.

Upon the installation of any system, the following points should be given careful consideration:

CARDINAL POINTS TO BE CONSIDERED

Method employed for separating the collected dust, dirt and bacteria from the air and disposing the same in a suitable receptacle.

Method employed for disposing of such collected dust, dirt and bacteria.

The type of vacuum pump or exhauster used, its construction, capacity, operating speed, drive, mechanical and volumetric efficiency.

Whether compressed air is furnished by the system for cleaning where vacuum is not applicable and for blowing out obstructions in the vacuum piping.

The volume of free air actually displaced per cleaning tool and the vacuum maintained at such time.

The method of controlling the displacement of the pump or exhauster while in operation.

Piping to be used in connection with the installation.

We propose to take up the subject briefly under the above headings.

DUST SEPARATION

The dust separation of every system should positively separate all dust, dirt and bacteria from the air, rendering the air clean and pure before it enters the exhauster and is finally discharged back to the atmosphere.

By investigating the various vacuum systems now on the market, we find various methods employed for separating this dust, dirt and bacteria from the air. Some use a screen, either wire or cloth, or a plate with perforations therein, which is known as the strainer plate, for the purpose of separating paper, string and heavier particles of dirt from the air. After this is effected, some of the systems employ a spray and what is known as a wet tank for separating the finer dust, dirt and bacteria, while in others they permit the finer dust, dirt and bacteria to pass through the exhauster, expelling the same direct to the atmosphere. This latter method is open to the ob-

jection that diseased germs (bacteria) are again released as a menace to health. A further difficulty in such separation is that the screens and strainer plate in separating paper, string and heavier particles of dirt from the air, are liable to become clogged with the same, causing resistance to the passage of air through such screens or strainer plate, reducing the volume of air used in cleaning and increasing the horse power necessary to operate the exhauster. The conditions existing in the system are constantly changing, it being a fact that the longer the system is in operation, the lower its efficiency.

Mechanically, this method of separation is faulty in that the dust and grit, which it is impossible to separate from the air, passes through the exhauster, whether the exhauster be of the rotary, centrifugal or reciprocating type, necessarily wearing and cutting the moving parts of the exhauster and materially shortening the life and efficiency of the machine.

Some rotary exhausters that are used in vacuum systems are constructed with a clearance between the moving parts for the purpose of reducing this wearing and cutting. This to a certain extent is accomplished, but the greater the clearance allowed in working parts, the lower the efficiency of the exhauster. To overcome this loss in efficiency, some systems have employed what is known as a water-seal, that is, a small stream of water continuously flowing into the exhauster to fill and seal this clearance and to prevent a certain amount of slippage. However, there are a number of objections to the use of this so-called water-seal, namely:

It necessitates an open connection with the sewer or catch-basin while the machine is in operation.

Such continuous discharge of air and water to the sewer causes a siphoning of the sewer traps of the building.

If the exhauster is placed below sewer level, the dirt, bacteria and water must be discharged into a catch-basin and an auxiliary pump used to carry the same to the sewer.

The water injected into the exhauster being heavier and more dense than air, additional horse power is required and the air displacement of the exhauster is decreased in proportion to the amount of water injected.

WASHING THE AIR COMMENDED

The ideal and sanitary method of dust separation can only be accomplished by washing and scrubbing the air, permitting the dust, dirt and bacteria to remain in solution. This fact seems to have been appreciated by the maker of a system of vacuum cleaning, which is now on the market. In this system the dust, dirt and bacteria collected through the cleaning appliances are brought directly to a hollow iron base of the vacuum exhauster where it enters a perforated cylinder submerged in water, in which cylinder there are a number of metal paddles revolving at high speed, designed to break up the air bubbles and mix the air and water, thereby releasing the dust, dirt and bacteria from the air, the same remaining in solution. The air so washed, being purified, rises above the water level in the hollow base and is taken up by the exhauster and expelled to the atmosphere direct, or through a discharge pipe running to some convenient place, for such discharge.

The construction of this separator is such that there is no possibility of pieces of paper, matches or dirt clogging the separator, causing resistance in the flow of air through the system, as the paddles revolving in the cylinder continuously expel such particles into the large base of the machine.

DISPOSAL OF COLLECTED DUST, DIRT AND BACTERIA

The majority of systems have drawers and pails in which the dust, dirt and bacteria is collected and these are taken out by the operator from time to time and contents emptied into some other receptacle and the same disposed of as conditions

will permit, possibly burned in furnaces, or, in most private homes, emptied into refuse barrels in the yard. In doing this the operator has merely disposed of heavy dirt and filth collected. He must also clean the screens or strainer plate, otherwise the efficiency of the system will be reduced by the clogging of the same and this cleaning of the screens and strainer plates must take place even in systems where a certain amount of lighter dust, dirt and bacteria are permitted to pass through the pump or exhauster.

The opening up of the vacuum machine and cleaning out of such dust, dirt and bacteria is extremely unsanitary and not only a menace to the health of the operator, but in handling the same, he is permitting the diseased germs and bacteria to escape into the atmosphere and be again carried through the building and in some cases where ventilating systems are employed, the vacuum machines are so located that these germs are picked up and again distributed throughout the building through such ventilating system.

In the system where a mechanical separator is used and the air is washed and scrubbed as heretofore stated, the air, dust, dirt and bacteria collected is held in solution in the hollow base of the exhauster, this hollow base being directly connected with the sewer, such connection being closed by a valve at all times except when the base is to be cleaned out. To clean out the base, a valve placed on the inlet to the base is closed and the valve in the sewer connection is opened. The type of exhauster used permits the reversing of the exhauster, converting it into a compressor whereupon the dirt, bacteria and water contained in the hollow base are discharged by compressed air into the sewer, and it is immaterial whether the exhauster be above or below the sewer level. The hollow base is so constructed that it drains in the direction of the sewer connection and, at the other end of the base, there is a ball-nozzle which directs a stream of water, during the cleaning out process, to the bottom of the base, loosening up such dirt that may have settled, so that it may be discharged into the sewer. The exhauster may then be reversed, the sewer connection closed and the valve to the system opened. The entire operation of disposing of collected dust, dirt and water does not exceed two minutes. The machine itself is never opened to the atmosphere and is hermetically sealed at all times.

TYPES OF EXHAUSTER

At the present time there are four types of exhausters being used in vacuum cleaning systems. These are the fan type, centrifugal type, rotary type and reciprocating type. The efficiency of a fan type exhauster, when maintaining a vacuum sufficient to do cleaning, is so low that it is hardly worthy of consideration. Fan exhausters were originally built and intended for handling a large volume of air, under practically no resistance, as in the case in ventilating systems, shaving and sawdust collectors, in planing-mills and work of this character. It is impossible to maintain over 1 or 2 in. of vacuum and then with a very low mechanical efficiency, which makes it absolutely impractical.

With the centrifugal type of exhauster it is possible to maintain some 6 in. of vacuum, but in accomplishing this, the efficiency of the exhauster is about 25% to 30%. Centrifugal fans are operated at a very high rate of speed, usually around 3,000 R.P.M. causing such frictional losses and wear on the bearings of the machine, including the motor, that the life of the machine is necessarily short.

The rotary type, most of which are constructed along the line of the positive Root blower, are capable of maintaining a higher vacuum than the two preceding types of machines and while operating at a medium vacuum will show a considerably higher efficiency than said machines. Rotaries usually are operated at a speed

of from 700 to 1,200 R.P.M. and when of positive rotary type with no clearance, they usually show a volumetric efficiency of 60% to 80% when operated at 4 in. to 6 in. of vacuum. However, this efficiency decreases very rapidly as the vacuum increases. This is, when maintaining a vacuum of from 10 in. to 12 in. the efficiency will not exceed 40% to 60%. A positive rotary exhauster can be used most successfully where the separator perfectly cleans the dirt and grit from the air.

Where complete separation of the dust and dirt from air is not effected, the rotary with a clearance and a water-seal is absolutely necessary, but the horse power in exhausting a given amount of air is materially increased on account of the pumping of this water.

The positive rotary exhauster is the only one, other than the reciprocating type, that is capable of operating under high vacuum. In performing such service, its operating cost is from 20 to 50% greater than that of the reciprocating type. A point in favor of the rotary exhauster for a vacuum cleaning system is its cheapness, if first cost only is considered, or where the power factor is so small that it is not necessary to give it consideration.

RECIPROCATING TYPE OF EXHAUSTER

The reciprocating type of exhauster is of two kinds: those fitted with poppet valves and those fitted with mechanically moved valves.

The ordinary reciprocating vacuum exhauster of the piston type, fitted with poppet valves, would show a volumetric efficiency of from 60% to 70%, and it is immaterial as to what vacuum is maintained, whether it be 2 in. or 12 in., the volumetric efficiency practically remains constant.

The reciprocating vacuum exhauster, fitted with mechanically moved valves, is noiseless and will show approximately a volumetric efficiency of 90%, which efficiency remains constant regardless of the amount of vacuum maintained. In view of this fact, it is evident how economical is the reciprocating exhauster when any considerable volume of air is to be displaced and the power factor is taken into consideration. This high efficiency accounts for the saving of from 20 to 50% in the operating cost. Furthermore, reciprocating exhausters are operated at approximately 150 R.P.M. and, at this speed, with proper care their life is indefinite.

Our attention has recently been called to the fact that the construction of some of the mechanically moved valves is such that by turning the valve 180°, the ports of the valve are reversed in relation to the piston so that instead of an exhauster we have a compressor. A positive rotary exhauster may be reversed with like results. This makes it possible to furnish compressed air for discharging the dust, dirt, bacteria and water into the sewer and for furnishing compressed air through the vacuum system for cleaning purposes where a vacuum is not applicable, such as the cleaning of radiators, relief work, backs of pictures, theatre scenery, etc.

There is a tendency for vacuum pipes and hose to become stopped up from time to time by matches or paper, the use of the compressed air under high pressure for blowing these obstructions from the pipe and hose is very essential in an up-to-date system.

There is no question but that some reciprocating exhausters now used in vacuum cleaning systems, are being operated at a very high speed, from 400 to 700 R.P.M., for the purpose of rating an exhauster with a large capacity or displacement. This point should be carefully considered in the investigation of systems either equipped with reciprocating exhausters or with rotary or centrifugal exhausters.

(*To be continued*)

Legal Decisions

Effect of Acceptance of Heating Plant by Owner

In an action to recover the contract price for the installation and furnishing of a low-pressure steam heating plant on the defendant's premises, according to agreement between the parties, the case was submitted to the court without a jury, and from a judgment for the plaintiff the defendant appealed. The evidence for the plaintiff tended to prove that the work contracted for was completed according to the special contract and was accepted by the defendant, that upon its completion the defendant admitted it was a satisfactory job, accepted it, and accepted an order from the plaintiff to a supply company for $400.00 for the boiler and radiators supplied for the plant, and in part payment of the contract price for installing the plant. The defendant offered evidence to show that the work was not done in a skillful manner, as agreed upon, and was never completed in accordance with the contract, and that the plant did not answer the purpose for which it was installed.

It was held on appeal that, the case having been submitted to the court below without a jury, its decision could only be reviewed on questions of law and not as to whether the finding of facts was correct or sufficient to support the judgment. The defendant having accepted the work after its completion, the plaintiff was entitled to recover therefor, although it should not have been done in strict conformity to the contract. It was conceded that the work had been done, and the defendant had accepted it and used the plant during a fall and winter. A prayer of the defendant that the court should allow him "an amount equal the amount necessary to put said heating plant in the condition called for by the contract "was held properly refused as assuming that the defendant was entitled to recover such an amount without stating any basis for the recovery. Judgment for the plaintiff was affirmed.—Turner vs. Egan, Maryland Court of Appeals.

Warranty of Furnace—Buyer's Duty

In an action to foreclose a mechanic's lien upon the defendant's house for the purchase price of a warm air furnace, the only question was whether there was a breach of warrant. The contract of sale of the furnace was oral. The furnace was a combination furnace and was warranted to properly heat the house in the coldest weather. It would not do this when fired with wood alone, except by means of excessive firing and attention. By using coal or coke as fuel it would, however, heat the house according to the warranty. It was held that there was no breach of warranty. There was no express warranty that the furnace would heat the house in the coldest weather when wood alone was used as fuel, but only that it would properly heat the house at that time. This it would do when the proper fuel was used and it was the duty of the defendants to use that fuel.—Wheeler & Son Co. vs. Edenhofer, Wisconsin Supreme Court.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

ELECTRIC HEATING

Electric Lighting and Heating (L'Éclairage et le Chauffage Électrique). A. Turpain. A brief history of the growth of the use of electricity for these purposes, with a short outline of modern appliances. Ills. 7200 w. Rev Gen des Sciences—Nov. 30, 1911. 40c.

GARAGE HEATING

Heating Private Garages. Briefly considers suitable methods. 1500 w. Horseless Age—Dec. 20, 1911. 20c.

HOT WATER

Gas-Heated Hot-Water Supply. Thomas Potterton. Illustrated description of hot-water supply apparatus with thermostatic control. 6500 w. Plumb & Dec—Dec. 1, 1911. 40c.

ISOLATED PLANT

The New York Public Library. Eugene E. Smith. Illustrated description of the features of this central generating plant for light, heat, ventilation and power, and the electrical equipment throughout the building. 4000 w. Elec Wld—Dec. 2, 1911. 20c.

PEAT

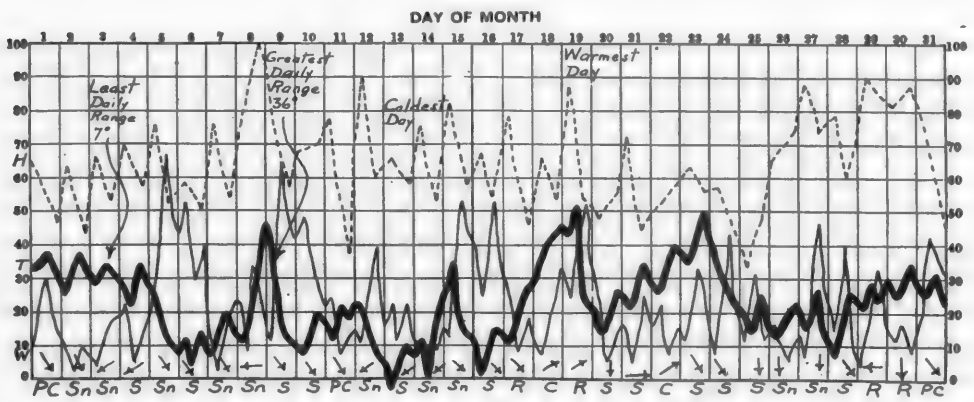
Is Peat an Important Fuel in the U. S.? Charles A. Davis. Abstract of a paper read before the Am. Chem. Soc. Map, and estimation of the peat beds and their value. 2500 w. Dec. 10, 1911. 20c.

VENTILATION

Ventilation of Passenger Ships. Anderson MacPhee. Illustrated description of a system designed to be used either as a plenum system when heating, or an exhaust system when no heat is required. 1500 w. Int Marine Engng—Dec., 1911. 40c.

The Weather for January, 1912

	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	52	53	54	38	58
Date of highest temperature	19	19	18	23	22
Lowest temperature, degrees F.	—3	—5	—6	—16	—14
Date of lowest temperature	13	13	13	7	7
Greatest daily range, degrees F.	36	33	37	29	32
Date of greatest daily range	9	9	9	21	21
Least daily range, degrees F.	7	6	5	5	5
Date of least daily range	3	4	25	5	27
Mean temp. for month degrees, F.	23.5	21	20	11.9	20
Normal mean temp. for month, deg. F.	30.2	27	30.7	23.7	31
Total rainfall, inches	1.86	2.87	1.9	0.84	1.31
Total snowfall, inches	9.0	17.8	13.8	7.1	13.2
Normal precipitation, this month, inches	3.79	3.32	2.87	2.0	2.27
Total wind movement, miles	14959	8840	10205	10595	9108
Average hourly wind velocity, miles	20.1	11.9	13.7	14.2	12.2
Prevailing direction of wind	N. W.	West	West	West	N. W.
Number of clear days	8	8	1	8	10
Number of partly cloudy days	9	9	10	8	9
Number of cloudy days	14	14	20	15	12
Number of days on which rain fell	15	13	24	12	5
Number of days on which snow fell	10	11	18	11	5
Snow on ground at end of month, inches	0.6	5.4	0.2	3.0	None


DAY OF MONTH
Least Daily Range 7°
Greatest Daily Range 36°
Coldest Day
Warmest Day
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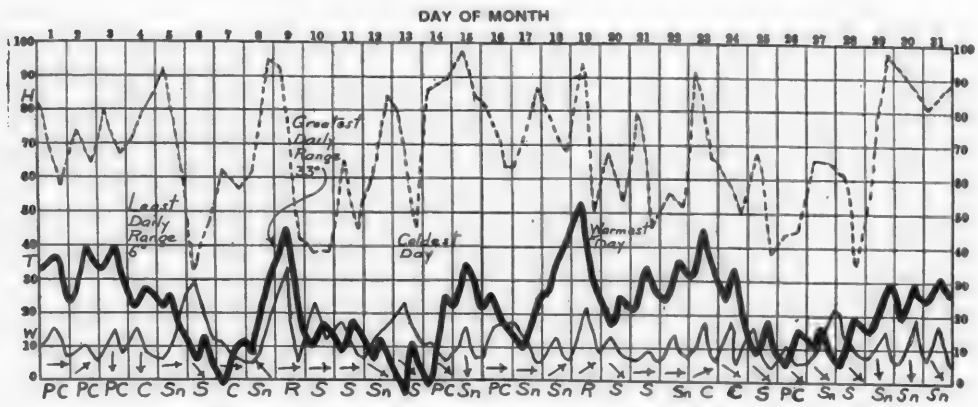
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY, 1912


DAY OF MONTH
Least Daily Range 6°
Greatest Daily Range 33°
Coldest Day
Warmest Day
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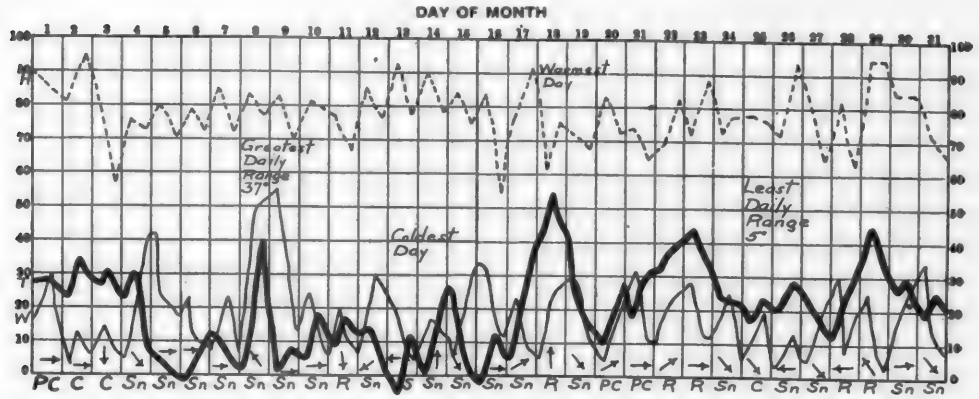
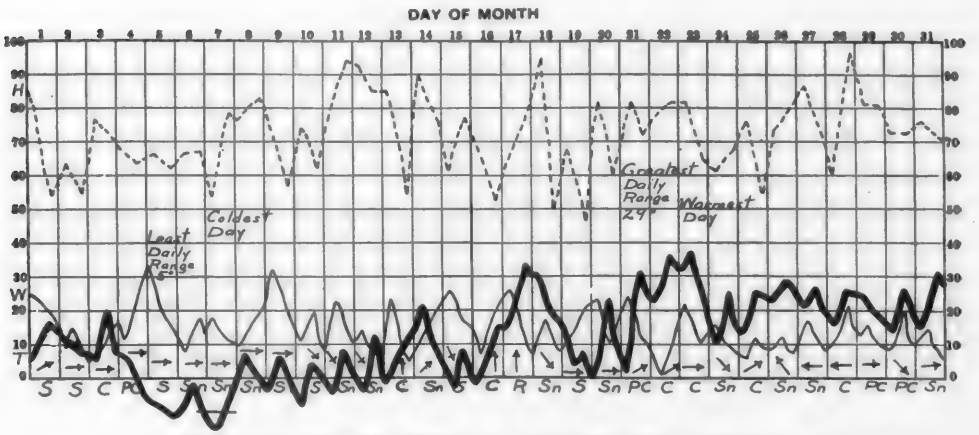
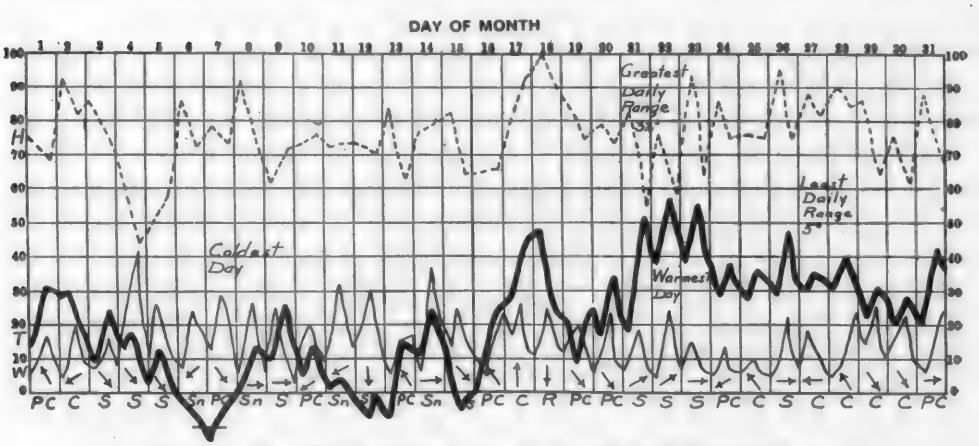
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1912



RECORD OF THE WEATHER IN PITTSBURG FOR JANUARY, 1912



RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1912



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1912

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate humidity in percentage from readings taken at 8 A.M. and 8 P.M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

Inspectors Wanted for Chicago's Bureau of Ventilation

Charles B. Ball, chief sanitary inspector of Chicago's Department of Health, has sent us a copy of the requirements for the two new positions created in the 1912 appropriation bill—one ventilation inspector in charge, $2400.00, and four ventilation inspectors at $1200.00 each. The Civil Service Commission has ruled that the examination for the principal position will be without regard to legal residence in Chicago. The date for the examination is March 20, 1912. Candidates are urged to inform themselves fully upon the seven ventilation laws governing operations of that nature in Chicago.

The duties of the ventilation inspector in charge will be the general direction and supervision, under the chief of the Bureau of Sanitary Inspection, of the division of ventilation in that bureau, charged with the administration of the seven ordinances pertaining to ventilation. These duties comprise the examination of the ventilation plans of new buildings, and of ventilating appliances introduced in old buildings, including especially hotels, office buildings, club houses, churches, theatres, lodge halls, schools, bakeries, restaurants, department stores and all places of employment. It will be his duty to scrutinize these plans as to the probable efficiency of the appliances provided and, in the name of the commissioner of health, to approve them when the appliances are such as may be reasonably expected to effect compliance with the ordinances.

His duties also comprise the examination of the sanitary efficiency of existing appliances or those installed in accordance with approved plans and their approval, if found to comply with ordinance requirements. He will be in immediate charge of the field inspection of all establishments and all public conveyances to which the ventilation laws apply as to the efficiency of the means of ventilation provided and the operation of such appliances. This will include the taking of proper air samples and their submission to the laboratory for analysis, the general supervision of the issuance of notices where violations are found, reinspection and abatement, as well as prosecutions, when necessary.

The four ventilation inspectors must be qualified to make volumetric records of air supply, to take air samples by approved methods and, in general, to note the sanitary conditions produced by the appliances when operated or the unsanitary conditions produced by lack of operation.

The need for an increased appropriation for the Chicago Health Department was discussed before the City Club of Chicago recently and is the subject of an interesting article in the *City Club Bulletin*, containing a detailed report of the meeting. One of the speakers, Charles B. Ball, chief sanitary inspector of Chicago, gave an interesting summary of the status of compulsory ventilation in Chicago and Illinois. Mr. Ball said, among other things:

"Chicago and Illinois are to be congratulated on the first ventilation law passed thirty years ago. The State of Illinois on May 30, 1881, passed a law providing that the Health Commissioner, in any city of 50,000 inhabitants or upwards, should be the authority to determine upon the plans of buildings which were to constitute places of habitation. So far as I have been able to find, that is the first state or municipal law in the United States with respect to ventilation. It provides that the Health Commissioner shall examine he said plans and specifications for his approval or rejection as to the ventilation of rooms, light and air shafts, windows, the ventilation of water closets, drainage and plumbing. Under the law we have authority to examine plans and, at the present time, two men are employed in the Sanitary Bureau as plan examiners. No plan goes to the Building Department for the issuance of a permit until it has passed through the Sanitay Bureau. But we are unable to administer that law of 30 years ago for the lack of purely scientific methods of determining upon ventilation.

"The second law to which I shall call your attention is the hospital ordinance which was passed on June 8, 1907. It provides first that hospital rooms shall have windows, and that in case said windows shall not secure 2,400 cu. ft. of air per hour by natural ventilation, each room shall be fitted with such appliances for ventilation as shall secure to each patient at least 2,400 cu. f. of fresh air per hour. Dr. Billings could tell you that what shall be done for the ventilation of hospitals is one of the most disputed points in the broad field of sanitation. I assure you that that law alone as applied to the 300 existing hospitals in the city of Chicago might well engage the attention of a very skilled man.

"The bakery law, Section 145 of the Code, provides that ventilating construction end equipment shall be of such character that a complete change of air in all parts of the bakery shall be made at least four times each hour. At the present time, we are unable to deal thoroughly and strictly with the remnants of our cellar bakeries, because of our inability to determine whether or not they fully comply with the requirements of the ordinance.

"The next subject is the street car ordinance. On January 31, 1910, Section 2210 of the Code was made enforcible

by the commissioner of health. Among other interesting provisions as to the sanitation of street cars, concerning which nothing has been done for lack of force up to this time, is this:

"Cars shall be so ventilated that the amount of air entering the car for ventilation shall be at the rate of 350 cu. ft. for each passenger per hour.

"Then it goes on to state how that air shall be delivered. The ventilation of street cars is a most interesting expert study at the present time. Very few street cars have been adequately ventilated up to the present time. That one subject would engage the attention of a number of people skilled in such matters.

REGULATION OF FACTORIES AND WORKSHOPS

"There has been for more than 20 years a requirement in our code as to the ventilation of factories and workshops. Section 1399 of the present code says:

" 'No person, being the owner, proprietor, lessee, manager or superintendent of any store, factory, workshop or other structure or place of employment where workmen and workwomen are employed for wages, shall . . . allow the same . . . to be overcrowded or inadequate, faulty or insufficient in respect of light, ventilation, heat and cleanliness; and in every such building or apartment, or room in any such building, where one or more persons are employed as aforesaid, at least 500 ft. of air space shall be allowed to each and every person employed therein, and fresh air supplied by ventilation at the rate of four complete changes of air per hour during the hours of employment. No part of such air supply shall be taken from any cellar or basement.'

"How many places of employment are there in this city? I asked a man today, who is thoroughly familiar with the subject, to determine that question and he stated that in his opinion there are around 70,000 places of employment to which this law applies.

"It is an interesting fact in that connection that the state law with respect to ventilation of factories and workshops is complicated in its provisions and is difficult of enforcement on that account. It is also interesting to note that in that state law is a provision that any city or municipality may pass laws with regard to sanitation, ventilation and lighting which are superior to the state law. It is interesting to note that our lawmakers should have incorporaed a clause of that kind allowing the city of Chicago or any other city to make superior provisions as in this case. So we have the state law for the ventilation of workshops and factories giving way to the provisions in our own ordinance.

"I would invite your attention to the fact that we have in this ordinance the most complete municipal law with respect to ventilation in existence. Only one other city, the city or San Francisco, has a municipal ventilation law, and that is inferior in many respects as to scope and definiteness to our own law which is in the building ordinance passed December 5, 1910, and effective January 12, 1911.

"The first class of structures to which this law applies is a threefold class, which includes office buildings, club houses and hotels. Those are exempted from certain provisions as to windows in water closet apartments, but it provides that in lieu of such windows they may be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour. That has to be proved by somebody. We have no one who is sufficiently authoritative in his knowledge of the subject to give such approval. Consequently we give approval without very much knowledge of the efficiency of such appliances.

VENTILATION EXPERT NEEDED

"It also provides that after the installation of such mechanical systems of ventilation they shall be tested for volumetric efficiency in the presence of a representative of the commission of health. We certainly have nobody in the department at the present time who is competent to determine the volumetric efficiency of such a system of equipment.

"There is also a provision in Article 20 for the ventilation of auditoriums, class-rooms, assembly halls hereafter erected and those already in existence. If there were no other functions for the ventilating engineer in the dpartment, his time would be quite fully occupied in passing upon the plans for such appliances. The number of theatres for which permits have been requested during two months is thirty; or churches, five; of assembly halls, eight; practically fifty structures in two months, one every two days, involving the broad application of that law as to buildings hereafter to be erected.

"We certainly will not get proper ventilation unless we are able to determine in an authoritative manner the plans which are provided for new buildings. There are at least 700 churches and large assembly halls in the city of Chicago which need to be considered as to their compliance with the law. In order to handle that matter in an adequate manner, there is no doubt we should be provided with a ventilating engineer and with assistants to do that work.

"The other evening I met with a number of groups who were talking over these questions, and after physicians, ventilating engineers and architects had spoken, they asked me what I knew about ventilation, etc., and I said I was not an architect or a ventilating engineer

or a doctor, but that I found it necessary to combine in the operation of my office the functions of those men. I said that I felt for the present at least it was a very difficult proposition to pass on these ventilating questions."

Massachusetts Chapter Organized

Permanent organization of the new Massachusetts Chapter of the American Society of Heating and Ventilating Engineers was effected at a meeting held in Boston, February 8, at the office of Frank Irving Cooper, of Cooper & Bailey. The meeting was presided over by H. W. Whitten, temporary president, and the following officers were then elected for the ensuing year: President, William G. Snow; Vice-president, Frank Irving Cooper; Secretary, Herbert W. Whitten; Treasurer, W. T. Smallman; Board of Managers, Joseph A. Moore, D. S. Boyden and A. B. Franklin.

The chapter has decided to hold regular monthly meetings from October to May, inclusive.

New York Chapter

The programme for the remaining meetings of the New York Chapter, before the summer recess, have been announced. At the March meeting two topics of interest will be presented: "Ventilation of Public Schools with Especial Reference to New York Practice." Mr Frank G. McCann, chief engineer of the New York City Board of Education, will present some facts to the members in regard to the New York schools. The second topic is "The Time Element in Regard to the Starting Up of House Heating Boilers."

At the April meeting the subject of air washers and humidity will be discussed.

For May, the topic is "Artificial Cooling of Buildings, Steam Traps and Vacuum Systems."

It is planned to hold the March and May meetings in some restaurant or hotel where dinner will be served to be followed by a professional session. The April meeting will be held in the Engineering Societies Building.

Factory Ventilation in New York State

The topic for the February meeting of the New York Chapter was "Factory Ventilation in New York State." Before opening the discussion the secretary read the bill on this matter which had been defeated in the legislature last year and which, he stated, would probably be brought before that body again this year. Among those who spoke on the topic were Dr. C. T. Graham-Rogers, and D. D. Kimball. It was voted that the chapter delegate the Committee on Factory Ventilation in New York State, as appointed by the heating engineers' society, to represent the chapter and use every effort to coöperate with the committees of other organizations to bring about practical legislation relative to factory ventilation.

Illinois Chapter Inspects Chicago Ventilation Commission's Experimental Room

The January meeting of the Illinois Chapter was the occasion for a visit to the experimental room in the Teachers' College where the Chicago Ventilation Commission is conducting experiments in heating and ventilation. The meeting was held in the room in question, which was described as the only experiment station in ventilation methods of its kind in the world.

It will be remembered that this room has a false floor and ceiling, the floor being made of two thicknesses of matched pine, between which are two thicknesses of tarred paper, to secure proper insulation. The air supply is brought down the intake shaft and delivered below the false floor, which is pierced by holes in which are fitted 3-in. galvanized pipes delivering the air underneath each desk. The false ceiling is made of brown paste-board, located about 6 in. from the regular ceiling. The exhaust air is taken through similar holes in the false ceiling. The room is occupied daily by four high school classes of boys and girls.

In recounting the observations already made, Prof. J. W. Shepherd, of the Chicago Ventilation Commission stated that a row of chairs arranged in the room to form an aisle, would cause a change of air currents. Toy balloons, he said, after rising would sometimes drop suddenly when near the wall, due to the temperature difference of the air and wall.

An ingenious method of determining when the air supply was uniform through the various inlets was described by Prof. Shepherd. Strings were extended across the room directly above the inlet pipes underneath the desks. Above these strings and across them at right angles were extended other lines of strings about 3 ft. below the false ceiling. On both the lower and upper lines of string were placed pieces of filter paper saturated with a solution of phenolphthalein (C_{20} H_{14} O_4) which will turn pink in response to the action of alkaline substances. A handkerchief saturated with ammonia was then placed in the air supply duct. Within 2¼ minutes every piece of paper on the lower level of

strings had turned pink and a similar effect was noted on the upper level of strings within 3 minutes.

The February meeting of the Illinois Chapter was devoted to "Humidity and Its Relation to Heating and Ventilating." A paper on the subject was presented by L. G. Soule.

New York Chapter Compiling List of Engineers

The New York Chapter is compiling a list of consulting, heating and ventilating engineers throughout the country and would be glad to receive from any source the names and addresses of such engineers. These should be sent to the secretary of the chapter, Joseph Graham, 154 Nassau St., New York.

Annual Meeting of the British Heating Engineers

A record year in the history of the (British Institution of Heating and Ventilating Engineers was reported on the occasion of its twelfth annual meeting, which was held at the Trocadero Restaurant, London, February 6. The total membership now reaches over 400, among the newly-elected members being Thomas Tait, engineer and chief draftsman for the Moline Vacuum-Vapor Heating Co., Moline, Ill.

CHARLES R. HONIBALL
President of the (British) Institution of Heating and Ventilating Engineers

After the retiring president, O. M. Row, had yielded the chair to the new president, Charles R. Honiball, Mr. Honiball delivered his address in which special reference was made to the work of the technical education committee and in regard to classes for students in heating and ventilation. Past President O. M. Row read a paper on "The Effect of Water Pressure in Prevening the Transmission of Heat from Steam Through Surfaces," and Herbert A. Jones, of London, presented a paper on "Automatic Temperature Regulation," in connection with which he exhibited a model apparatus which evoked much interest. Another speaker was Dr. Leonard Hill, of the London Hospital, who gave an address on ventilation and showed a window ventilator controlled by the temperature of the room.

The usual dinner followed the meeting, which was considered highly successful.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Date Set for Annual Convention

The twenty-fourth annual convention of the National Association of Master Steam and Hot Water Fitters will be held at Atlantic City, N. J., June 10-13, 1912. Headquarters will be at the St. Charles Hotel.

1912 U. S. Standard Flange Schedule

Under the auspices of the American Society of Mechanical Engineers, the National Association of Master Steam and Hot Water Fitters, and the American Society of Heating and Ventilating Engineers, a new schedule of standard weight and extra heavy flanged fittings and flanges, to be known as the 1912 U. S. Standard, has been designed for the higher steam pressures that are being carried. The new schedule is printed in pamphlet form and copies may be had by addressing either of the organizations above mentioned.

Annual Meeting of Wisconsin Association

The first annual convention of the Wisconsin Association of Master Steam and Hot Water Fitters was held at Oshkosh, Wis., Feb. 13, immediately preceding the convention of the Wisconsin Association of Master Plumbers. It is planned to hold the meetings of the two associations as near the same time and place as possible. The present membership of the association, which was organized last July, is 60, seven new members being added to the roll at the convention. National President Edward B.

Denny and President George F. Reeke, of the Wisconsin Association of Master Plumbers, were among the speakers. A committee on trade relations composed of W. S. Patterson, Appleton; James A. Trane, La Crosse; and F. E. Green, Janesville, was appointed to confer with a similar committee of the master plumbers.

During the convention National President Denny was presented with an Italian vase by the Wisconsin Association of Steam and Hot Water Fitters. The officers elected at the organization meeting in July were re-elected as follows: President, Edward Grassler, Milwaukee; Vice-president, James Ahearn, Fond du Lac; Recording Secretary, F. H. Meadows, 497 East Water St., Milwaukee; Secretary-Treasurer, Fred Kaufman, Milwaukee; Directors, C. J. Fox, Milwaukee; James A. Trane, La Crosse; Hugo Franke, Eau Clair, and B. B. Shine, Green Bay.

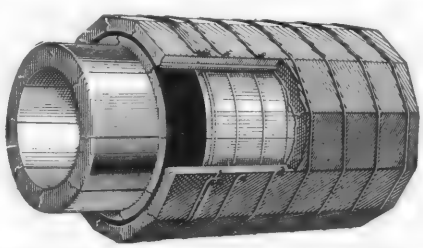
New Quarters for Philadelphia Association

The Master Steam and Hot Water Fitters' Association of Philadelphia, announces that it has moved to larger and more comfortable quarters at 1518 Sansome St., Philadelphia.

NEW DEVICES

Improved Type of Underground Pipe Covering

Notable improvements in the construction of the well-known Wyckoff underground steam pipe covering, manufactured by the A. Wykoff & Sons' Co., Elmira, N. Y., are shown in the accompanying illustration. The most important feature in the construction of the covering is the use of Gulf cypress instead of pine. Gulf cypress is known not to rot under wet and dry conditions, thus greatly increasing the lasting qualities of the covering. Other improvements are an increase of 50% in the dead air space between the shells and an increase in the thickness of the inner shell from 1 in. to 2 in. to obviate the danger of collapse due to heavy loads.

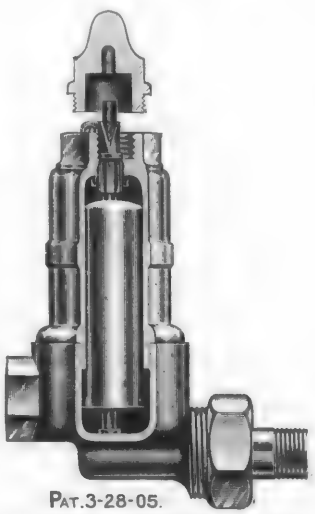


NEW WYCKOFF UNDERGROUND STEAM PIPE COVERING

The Simonds Vacuum Valve

A frigid time is coming, two hundred years hence, more or less, when coal will be found only in museums.

This does not worry us to-day, but show the man who spent $1,000 to warm his factory last winter, how $700 would have been ample. He sits up and listens. He wants that lost $300, for more coal bills are coming. Show him where the loss occurred and how to prevent it and you have accomplished a practical result. There will be at least a little coal left at the end of two hundred years.



PAT. 3-28-05.

SIMONDS VACUUM VALVE

The public of to-day have little use for a doctor who sends in his bill with his diagnosis. What they want is a prescription and a cure. That is the "burning" question.

In heating work, the prescription and cure lie in many instances, in the installation of a practical economical vacuum system of heating. The installation effects this.

One notable type of vacuum valve which is the principal feature of the system and which may be connected to any existing system of vacuum heating, is an automatic device operated by a float and, being perfectly balanced by reason of the upper or air discharge valve being of the same unbalanced area as the lower valve or water discharge, one will operate under any reasonable steam pressure or any degree of vacuum.

The suction of the return line vacuum extends through the hollow stem to the upper float chamber and valve. The air that is carried along with the water of

condensation naturally collects above the water, in the dome case; and until sufficient water accumulates in the case to float the valves of their seats they are both tight on them.

When the float raises, the lower valve discharges the water, and the air passes through the upper valve and is drawn down through the tube that forms the stem to which both valves and the float are fastened.

But the amount of air discharged is regulated by an adjustable vent into this tube, so that positively no steam is drawn into the return line to be wasted.

By means of the clamp upper valve, both valves can be adjusted tight on their respective seats after steam has been blown through them and all expansion has taken place.

The lower valve has no guide wings or pins to retain the pipe scales or sediment coming along with the water. Therefore, when off its seat, it has free discharge for such foreign matter, and as the opening under the valve is from 4 to 16 times the usual area in float types of vacuum valves, the trouble from clogging is nonexistent.

As extraneous matter cannot rise above the water line there can be no fouling of the vent of the upper valve.

The qualities of this valve have been attained by F. A. Simonds, of the Simonds Heating and Specialty Company, Grand Rapids, Mich.

New Books

Mechanics of Heating and Ventilation, by Konrad Meier, is a new work containing a collection of data relating to the flow of water, steam and air, gathered by Mr. Meier in the course of his long experience in heating and ventilating work, both in this country and abroad. The feature of the book is a series of ten charts, each covering a special field, such as gravity hot water heating and forced ventilation. Each of these charts replaces a series of tables on the subject. There is little that is new in the underlying theories, but the graphic method as worked out permits the correct application of the theories in practice. The text is not a general treatise, but in confined strictly to a short exposition of the mechanics of the subject. A special set of charts are available, printed on cloth, with lines in different colors, and mounted on boards. The single charts sell for $1.50 apiece or $15.00 per set. The book itself contains 161 pages, 6x9 in., and may be had containing the ten charts for $5.00 postpaid. The book is published by the McGraw-Hill Book Co., New York, and copies are for sale by the Heating and Ventilating Magazine Co., 1123 Broadway, New York.

January's High Fire Record

The month of January gave the year 1912 a bad start in the matter of fire loss, the total contribution to the ashheap in the United States and Canada amounting to $35,653,450, compared with $21,922,450 for January a year ago and $15,175,400 for January, 1910. The Equitable fire in New York City is set down for $3,000,000 in the exhibit. There was another heavy fire loss in New York City, that of the terminal warehouses, involving a destruction of $1,100,000. There were thirty-five fires during the month in which there was a loss of $200,000 or over. The abnormally cold weather made the liability to fires greater than usual, on account of the over-taxing of heating arrangements and the difficulty of using extinguishing apparatus to advantage.

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We Win

The United States Circuit Court of Appeals holds that the MONASH RADIFIER VALVES do not infringe the Van Auken Patent and orders that the bills of complaint filed against us by the Consolidated Engineering Company and Byron E. Van Auken be dismissed.

MONASH-YOUNKER CO.

CHICAGO NEW YORK

TRADE AND MISCELLANEOUS NOTES

Coming Events

Second Tuesday in Each Month—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies Building, 29 West 39th street, New York.

June 10-13, 1912, inclusive, twenty-fourth annual convention of the National Association of Master Steam and Hot Water Fitters, Atlantic City, N. J. Headquarters will be at the St. Charles Hotel.

June 25-27, 1912—Fourth annual convention of the National District Heating Association, Detroit, Mich. Headquarters at the Hotel Cadillac.

Deaths

Charles Hart, president and treasurer of the Hart Mfg. Co., Cleveland, O., manufacturers of pipe threading tools, died February 9, of heart failure. He was 62 years old. Mr. Hart had not been well for some time and his son, L. F. Hart, vice-president of the firm, had been in active management. The business was started by Mr. Hart 30 years ago.

Edward A. Downey, sales manager for St. Louis of the National Tube Co., died suddenly January 26, in St. Louis, while on his way to his home in that city. Mr. Downer was 55 years old and had been associated with the National Tube Co. for over 26 years.

Miscellaneous Notes

Federal Furnace League, Philadelphia, has issued its long-awaited Federal System of Heating and Ventilation, copies of which may be had by addressing the League, 1530 Penn Square, South, Philadelphia.

George Huey, of Huey Bros., Boston, is leaving that city to move to Toronto, Ont., to become president of the Canadian Domestic Engineering Co., of Toronto. On the occasion

THE McCREERY AIR SCRUBBER

Spray alone will not wash out **soot** and other **oily particles** from the air. These are what produce the **"smoke nuisance."**

Our Air Washers have therefore always been built with wet **cleaning surfaces** to catch the dirt and assist in humidifying and cooling the air.

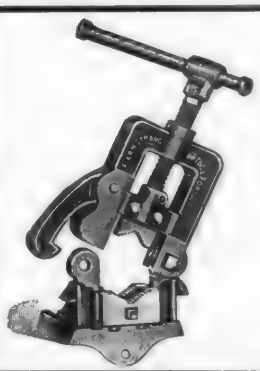
The **flushing spray heads,** brought out by our Company, are now recognized as necessary to the uninterrupted operation of Air Washers and are specified by the leading Engineers.

The **Experimental Plant** originally installed by us in 1907, has been remodeled from time to time in order to obtain valuable knowledge of air conditioning.

We specialize in **Industrial Work,** as the high efficiency of our cleaning and humidifying device enables us to overcome difficult conditions.

Correspondence solicited.

McCREERY ENGINEERING COMPANY, DETROIT, MICH.



ARMSTRONG MALLEABLE IRON HINGED VISES.

No. 0	Holds Pipe	⅛ to 2 ⅛ in.	11 lbs. each
No. 1	" "	⅛ " 2½ "	16 " "
No. 2	" "	⅛ " 4⅛ "	30 " "
No. 3	" "	1 " 6 "	35 " "

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NEW YORK **BRIDGEPORT, CONN.** CHICAGO

of his departure Mr. Huey was presented with a traveling bag by the Everett Veterans' Firemen's Association.

United Bunch of Sheep, New York Fold, elected the following officers at its recent meeting in New York: Grand Ram, William M. Murray; vice-grand ram, Paul Shwab; past grand ram, Thomas H. Hutchinson; shearer, J. W. Gannon; keeper of golden fleece, Henry Stein; shepherd, Frank Silkman; guide, Victor A. Harder, Jr.; herder, J. E. Maire; bell sheep, J. S. Thomas; trustees (for three years), E. C. Molby; (for one year), J. S. Thomas; degree team, Victor A. Harder, Jr., C. B. Yardley, Jr., Frank Silkman, E. C. Molby and J. S. Thomas.

Illinois Plumbing and Heating League was organized at Decatur, January 23, by master plumbers who are also engaged in steam and hot water heating work. The association, it is understood, will work in harmony with the Illinois Master Plumbers' Association. Officers elected were: President, Clarence Ruddy, Aurora; vice-president, J. E. Fitzgerald, Lake Forest; secretary, L. F. O'Flaherty, Elgin; treasurer, E. C. Barrett, Joliet.

Detroit, Mich.—In connection with the suit of the Government against the so-called "bath-tub trust," the Government has nolle prossed the indictments against W. C. Winfield, Warren, O.; J. J. Mahoney, Wheeling, W. Va., and Bert O. Tilden, New York. This action reduces the number of defendants to thirteen firms and twenty-four individuals.

New Ulm, Minn.—The question of the feasibility of utilizing the exhaust steam from the electric light and water works plant by installing a municipal steam heating system, was made the subject of a special favorable report by Earle D. Jackson, of St. Paul, Minn., the city's consulting engineer. The report is based upon a system that will, for the present, serve only three business blocks on Minnesota street, but built large enough so that it can be extended if necessary. Such a plant, complete with wood casing, is estimated to cost $13,000 and, with concrete casing, $16,000. This estimate does not include the cost of making the connections with the owners' property. This expense would have to be borne by the owner himself. Assuming that 18,000 sq. ft. of radiation would be connected within a period of two years without extending the mains, the engineer estimates the net revenue as follows:

GROSS RECEIPTS:	
18,000 sq. feet of radiation at $0.30 per cq. foot per season	$5,400.00
EXPENSES:	
Coal for live steam	$1,200.00
Incidental expenses (estimated)	440.00
Interest at 5% plus depreciation at 6% on $16,000	1,760.00
	$3,400.00
Estimated yearly surplus	$2,000.00

Expressing the above proposition in another manner, in accordance with the report of the Electric Light Department:

Receipts as before	$5,400.00
EXPENSES:	
Coal for live steam	$1,200.00
Incidental expenses (estimated)	440.00
Interest at 5% on $16,000.00	800.00
	$2,440.00
Balance for depreciation	$2,960.00

This is equivalent to 18.5% on the investment of $16,000.00, or in other words, the entire heating system would pay for itself in 5.5 years. This is practically twice the return on the investment as shown by the local electric light plant, averaged over the last few years.

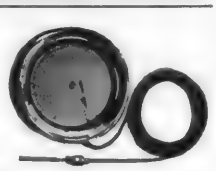
The revenue as estimated is based on an income of 30 cents per square foot of direct radiation per season.

Buhl, Minn.—The new municipal heating plant has begun operations and steam has been turned into the pipes. The entire system will entail an expenditure of $25,000, but the amount so far spent does not exceed $16,000. It is expected that the balance of the plant will be completed during the coming year. The present charges for service as fixed by the village council at 18 cents per square foot for residences and 19 cents for business blocks.

Monroe, Mich.—Judge Golden has appointed W. H. Jose, of Monroe, receiver for the Practical Heating Co., of that place, and has ordered that the assets of the corporation be sold for the benefit of the creditors.

Des Moines, Ia.—In connection with the movement inagurated by the local smoke abatement commission, to centarlize the city's heating plants, Paul Beers, the chairman of the commission, has written to the city council stating

INDUSTRIAL INSTRUMENTS



Refinement of little things gives "INDUSTRIAL" Indicating and Recording Thermometers Character, and makes them Accurate and Durable. Send for Bul. 58 and find out about them.

THE INDUSTRIAL INSTRUMENT COMPANY, Foxboro, Mass.

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that between 1880 and 1890 J. S. Polk had an exclusive franchise but that it then ceased to become exclusive. The commission recommends that an ordinance be passed granting franchises to individuals, corporations or estates to lay heating mains so as to encourage individuals owning heating plants to furnish heat to the surrounding buildings. The request was referred to the legal department, with the suggestion that steps be taken to repeal any franchise now said to be in force.

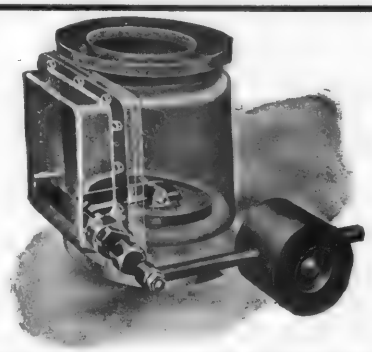
Kansas City, Mo., Star is authority for the statement that Dr. Woods Hutchinson contends that schools should be constructed with walls on two sides only and asks, "But why not make the school T-shaped, thus requiring only one wall?"

Kalamazoo, Mich.—As a result of hearings on the matter of the pending franchises for a central heating station for Kalamazoo, the two proposed franchises offered by the W. H. Schott Co. and the Central Station Engineering Co., respectively both of Chicago, have been turned over to the city attorney with instruction to draft a new franchise that will embody the favorable points of each proposed franchise.

Cleveland, O.—A series of central heating stations, supplying steam heat to the residences of Cleveland is the municipal enterprise that should follow the successful operation of the new municipal lighting station soon to be erected on the lake front, adjoining the Kirtland pumping station, in the opinion of F. W. Ballard, consulting engineer. The plan, as outlined by Mr. Ballard, does not mean a combined heating and lighting plant, but that the success of the new lighting plant will point the way for the development of other municipal activities, including central heating systems.

Council Bluffs, Ia.—The unusual spectacle of a large mogul passenger engine furnishing steam heat for the passenger station of the Chicago & Northwestern Railroad at that place was witnessed during the recent cold snap due the burning of the local freight station, in the basement of which was located the heating plant for the passenger station. The engine was run to a side-track over the tunnel through which the heating mains were carried to the passenger station. An opening was then made in the tunnel and connection made from the steam pipes to the locomotive.

New York—A recent decision of the New York State Court of Appeals rules that the landlord of an apartment house containing its own heating plant is obligated to furnish a tenant sufficient heat and "if he fails to furnish it, the tenant



EXCELSIOR STRAIGHTWAY BACK PRESSURE VALVE

A glance at the illustration will show its extreme simplicity and freedom from complicated parts. It has an area through the seat equal to that of the pipe.

As a back pressure valve it can be used in a vertical or horizontal position. It is especially desirable for exhaust steam heating. Also well adapted for use as a relief or free exhaust valve for condensing engines.

JENKINS BROS., New York, Boston, Philadelphia, Chicago

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may vacate and thereafter resist the collection of the rent stipulated to be paid." The question, however, of what constitutes "sufficient heat" does not appear to have been decided.

St. Joseph, Mo.—The Public Utilities Commission has declared extortionate the rates charged by the St. Joseph Railway, Light, Heat & Power Co. for electrical current for lighting and power and steam for heating purposes. The commission is to start an investigation with a view of securing a reduction in the rates.

United Bunch of Sheep, Milwaukee Fold No. 1, elected the following officers at its February meeting: Grand ram, J. F. Wulf, Robert Rom Co.; vice-grand ram, F. H. Meadows, Marvel-Spencer Heating Co.; shepherd, James E. Brady, Wisconsin Plumbing & Heating Co.; shearer, A. L. King, H. W. Johns-Manville Co.; keeper of the golden fleece, F. C. Wagner, Hoffman-Billings Co.; director (for three years), F. E. Young, Rundle-Spence Mfg. Co.

Louisville, Ky.—The Kentucky Heating Co., which sells fuel gas, using the city's streets for its mains, is the defendant in a suit in which the city of Louisville is a joint plaintiff, the charge being that the company is operating without a franchise. The Kentucky Heating Company was granted a 20-year franchise in 1878 which expired in 1908. The company, however, claims that it possesses a right to operate for ten or twelve years more under a grant given by the State legislature to one of the companies it has acquired. The company has lately expressed its willingness to purchase a new franchise from the city, but the question of rates is expected to be an important obstacle as they undoubtedly will be up for revision. In the meantime it is reported that the Kentucky Heating Company and the Kentucky Electric Company are likely to be merged. The two companies are not competitors, the former selling fuel gas and the latter electricity exclusively.

Massachusetts Boiler Inspection Regulations now provide that both boilers used for power and for heating purposes shall be rated alike at 3 H. P. per square foot of grate surface or equivalent when the safety valve is set at over 25 lbs. per square inch. When the safety valve is set at or below 25 lbs. the rating is 1½ H. P. per square foot of grate or equivalent. It has been found that in some cases, under the former arrangement, heating boilers used for heating have been carrying 125 lbs. of steam and were exempt while some power boilers carrying 25 lbs. were subject to inspection.

Eastern Supply Association, at its meeting held Feb. 14, 1912, unanimously adopted the following rsolution:

Be it Resolved by the Eastern Supply Association at a regular meeting held February 14, 1912, that we, the members, desire to place ourselves on record as reaffirming Operative Resolution on Consequential Damages adopted June, 1908, and that we are furthermore unalterably opposed to any proposition, whether by manufacturers or jobbers, whereby we would be liable for any replacement charges or expense of any

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FOR 1912 TO

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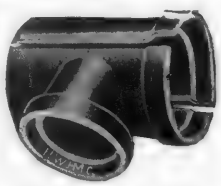
Saves Over 90% of Heat Lost from Bare or Poorly Protected Underground Pipes



With steam pipes installed in J-M Sectional Conduit, loss of steam by condensation is prevented. This conduit carries steam through thousands of feet of piping with practically no loss. It saves over 90% of heat lost in transmission through poorly insulated pipes.

Is unequalled for conveying steam, gas, water, brine or other liquids underground.

Acids, gases, and the chemical action of the earth, do not affect it. Can be taken up and relaid without injury. Is practically indestructible.

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Detroit	New York	

1475

nature whatsoever in connection therewith.

We furthermore recommend that a copy of this resolution be sent to all manufacturers and jobbers of plumbing supplies.

The operative resolution on consequential damages referred to was adopted by the Eastern Supply Association in 1908 and reads as follows:

Resolved, That new material will be furnished for any goods proving defective when used for the purpose manufactured, but no claim for labor or damages will be allowed.

Milwaukee, Wis.—A Milwaukee company has perfected a plan for producing power from crude petroleum, which is said to be unrivalled in cheapness and efficiency. The invention is the adaptation of the producer gas engine to gas created from crude petroleum. Its successful application will mean a revolution in marine power and it will also be especially useful in reclaiming land in the arid sections of the world. The idea originated with a Californian, Arthur Grine, who was the first to perfect an apparatus capable of extracting the gas from the oil. The application of a system of control, rendering the apparatus suitable for commercial use, has been worked out by Edward T. Adams, of Milwaukee, one of the designing engineers for the gas engine plant of the United States Steel Corporation, at Gary, Ind., and his assistant, Nesbitt Latta. The announcement is made that the Wisconsin Engine Co., of Corliss, Wis., which is now controlled by Milwaukee capital, has closed a deal to all of rights of involving all the rights to patents covering petroleum gas producers.

Department of Industrial Research, University of Pittsburgh, is entering upon a study of the smoke problem in a broad manner. The investigation is under the immediate direction of R. C. Benner, Ph. D., and W. W. Strong, Ph. D., and will cover the effect of smoke upon health, plant life and buildings. The department is also considering the increased cost of living due to damage and dirt caused by smoke, and the legal as well as the engineering side of the question. Each of these investigations will be carried out by one or more men, specialists in their respective lines. The department desires to get in touch with all who are interested in this subject with a view of securing their coöperation, information and suggestions.

Positive Ventilation of Toilets

no matter where located is possible by the

Sturtevant

METHOD

OF TOILET VENTILATION

This apparatus which consists of a Sturtevant Ready-to-Run Ventilating Set with special intake and discharge ducts, is very easy to install, may be purchased at small cost, and its operating expense is extremely low.

The air in toilets entirely without means of natural ventilation may be kept sweet, pure and free from obnoxious odors. The apparatus is positive in action regardless of weather conditions. Its operation is independent of the main ventilating system.

The sanitary laws for toilet ventilation are fully met by the installation of this apparatus.

B. F. STURTEVANT COMPANY

Hyde Park, Boston, Massachusetts

Offices in principal cities

888

Manufacturers' Notes

H. W. Johns-Manville Co., New York, announces the removal of its Pittsburg branch to Wool street and First avenue. The company will occupy the entire eight-story stone, reinforced concrete and steel building at that point, containing a gross floor space of 23,808 feet and providing ample space for the display of the company's asbestos, magnesia and other products.

National Tube Co., Pittsburg, Pa., will build a Canadian plant at Fort William, Ont.

Ohio Blower Co., Cleveland, O., manufacturer of the Swartwout rotary ball-bearing ventilator, has secured a site at Ivanhoe, East Cleveland, where it will shortly build a new two-story plant. The main building will be 60 x 140 ft., with a wing 70 x 70 ft. and a two-story office building 40 x 50 ft.

Westfield Foundry & Valve Co., Westfield, Mass., is manufacturing the Dodge boilers and furnaces sold by August W. Dodge, Springfield, Mass. Mr. Dodge, who is a director and general sales manager of the Westfield firm, has moved to that city.

Consolidated Engineering Co., Chicago, Ill., held a convention of its engineering and sales forces at the Great Northern Hotel, Chicago, during the week of January 29. At a dinner at the La Salle Hotel, which brought the convention to a close, President T. J. Leonard and Secretary B. E. Van Auken of the company were each presented with a gold fob, the gifts of the employes and representatives of the Consolidated Engeening Co. The presentation speeches were made by T. G. Wade.

Bottom Valve Co., Chicago, Ill., announces that H. O. Walker has withdrawn his interests from the company and that the business will be continued by George L. Bottum.

J. H. Williams Co., Brooklyn, N. Y., has purchased an extensive tract of land at Buffalo, N. Y., on which it will build a plant for the manufacture of drop-forged tools.

Monash-Younker Co., Chicago, Ill., announces that the suits brought against this company by Byron E. Van Auken and the Consolidated Engineering Co., for infringement of the Van Auken patents, have been decided in favor of the Monash-Younker Co. The United States Circuit Court of Appeals has just handed down its decision that the Monash Radifier valve is not an infringement of the Van Auken patents. These suits have been in the courts for the past three years.

Victor Cleaner Co., which controls Broomel's system of vacuum cleaning, whose main offices are at York, Pa., and not Philadelphia, as was inadvertently stated in our last issue, has opened New York offices with the Vapor Heating Co., 1123 Broadway. The company has installed a stationary vacuum cleaning plant at this address and is prepared to give a practical demonstration of the capabilities of the machine. The office is in charge of Charles E. Scott.

GOOD BYE

STEAM TROUBLES, GOOD BYE!

THE SIMONDS AUTOMATIC VACUUM VALVE will freely pass all particles of rust, pipe scales or sediment and will not clog up, although closed absolutely tight against steam waste.

AN ABLE VALVE + ST = A STABLE VALVE

The Detroit Forging Co., Detroit, Mich., says: "30% saving on coal bill."
Write to-day for economical information

SIMONDS HEATING & SPECIALTY CO.
DEPT. 5 **GRAND RAPIDS, MICH.**

BETTER THAN LEAD Dixon's Pipe Joint Compound is better and cheaper than red or white lead.
Doesn't "set" joints—goes farther.
JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

New Firms and Business Changes

Citizens Electric Light & Power Co., Lebanon, Ind., has increased its capital stock from $100,000 to $200,000, to provide for the installation of a central heating system in connection with its power plant.

Jahant Heating Co., Akron, O., has increased its capital stock from $30,000 to $50,000.

New Corporations

Niagara Metal Weather Strip Co., Niagara Falls, N. Y. capital $20,000. Incorporators: Frederick S. Franklin, C. H. Franklin and Freeman H. Palmer.

S. E. T. Valve & Hydrant Co., capital $30,000, to make valves, hydrants, etc. Incorporators: D. S. Sealey, Hampstead, N. Y.; E. D. Every, Walton, N. Y., and C. E. Tyler, Passaic, N. J.

Miles City Plumbing & Heating Co., Miles City, Mont., capital $10,000.

A. L. Rudderow Plumbing & Heating Co., 301 Market street, Camden, N. J., capital $2000. Incorporators: Albert L. Rudderow and others.

American Heating and Plumbing Corporation, Chicago, capital $60,000, to conduct a heating and plumbing contracting business. Incorporators: F. Arthur Thorpe, Mark E. Guerin and Ferdinand Goss.

Contracts Awarded

McGinness-Smith Co., Pittsburg, Pa., heating and ventilating new First Baptist Church Building at Bellefield for $10,000; also heating new $100,000 Y. M. C. A. Building at New Castle.

Frederick Webster Heating Co., New Castle Junction, Pa., heating station at New Castle for the Pittsburgh & Lake Erie R. R. Co.

Johnston Heating Co., New York, heating and ventilating new high school at Waverly, N. Y., for $7,250.

Cambria Plumbing & Heating Co., Johnstown, Pa., heating, plumbing and tinning for the new hotel and store building at Colver.

George R. Bernhard, Allentown, Pa., installing hot air heating plants in a row of fourteen new houses at Fourteenth and Union streets for Kummery & Butterweck.

Bangor, Me.—Bids for the heating, ventilation and plumbing of the new high school and library buildings at Bangor were opened February 13 and were as follows:

HIGH SCHOOL—HEATING AND VENTILATION.

Willey & Calhoun, Portland	$24,350
C. H. Babb & Co., Bangor	24,723
Huey Bros., Boston	25,747
Bradley & Chatman Co., Boston	25,870
C. H. Sanborn, Boston	25,950
Lynch & Woodward, Boston	26,396
L. W. Taylor, Boston	27,200
Albert B. Franklin, Boston	27,963
E. F. Kelley & Sons, Bangor	28,790

HIGH SCHOOL—PLUMBING

C. H. Babb & Co., Bangor	$9,133
John H. Fitzgerald, Boston	9,884
E. F. Kelley & Sons, Bangor	9,972

LIBRARY—HEATING AND VENTILATION

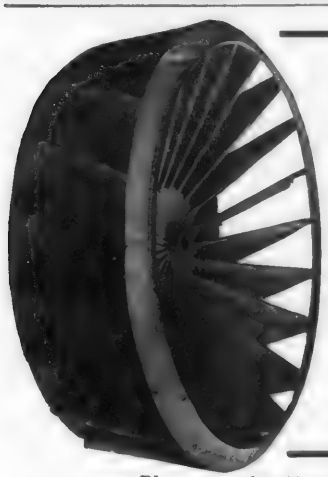
Huey Bros., Boston	$8,197
Willey & Calhoun, Portland	8,300
Bradley & Chatman Co., Boston	8,600
A. B. Franklin, Boston	8,667
L. W. Taylor, Boston	8,803
C. H. Sanborn, Boston	8,860
C. H. Babb & Co., Bangor	8,888
Lynch & Woodward, Boston	8,970
E. F. Kelley & Sons, Bangor	8,998
Leighton Plumbing and Heating Co., Bangor	10,225

PLUMBING—LIBRARY

C. H. Babb & Co., Bangor	$2,383
E. F. Kelley & Sons, Bangor	2,898
Leighton Plumbing and Heating Co., Bangor	2,900
John H. Fitzgerald, Boston	4,809

Salesmen Wanted

Vohr Ozone Electric Company, 154 Nassau St., New York, is looking for some good, aggressive salesmen to sell ozone apparatus. Those having a knowledge of ventilation will be given the preference, and anyone interested should communicate with this company.



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for all purposes. The only radical improvement in fans in forty years. Takes up less room, runs at slower speed, requires less power, noiseless in operation.

We guarantee our Cycloidals to equal in capacity any fan built—We bar none—with from 20 to 25 per cent. less speed and power. We build them in all sizes to suit all conditions—hundreds of them in use—not "as good—but better."

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Trade Literature

Grinnell Automatic Sprinkler Bulletin, for January, 1912, published by the General Fire Extinguisher Co., Providence, R. I., contains details of the fire prevention campaigns started by the Chambers of Commerce in Rochester, N. Y., and Boston, Mass. The Boston committee declares that that city is in peril of fire and that disastrous conflagration may be expected at any time. To prevent such a disaster the committee offers recommendations for city ordinances, among which is the passage of a law requiring all second or third-class buildings within the congested business district to be equipped with sprinklers. This, of course, excepts houses of habitation.

Cochrane Heaters, Their Use in Steam Power Plants for Heating and Purifying Water for Boiler Feed and Other Purposes, a 144-page publication issued by the Harrison Safety Boiler Works, 3189 North 17th street, Philadelphia, contains a remarkably complete account of what may be called "exhaust steam engineering." The range of topics includes such subjects as: the choice of a system for heating boilers feed water; the relative economics of electric and direct-driven auxiliaries vs. steam-driven auxiliaries where the exhaust from the latter is used for heating the boiler feed water; the utilization of exhaust steam for heating and drying work, and for the operation of low pressure turbines; the operation of open feed water heaters in multiple; the pumping of hot water, etc.

The catalogue describes the several appliances manufactured by the Harrison Saftey Boiler Works for use in connection with the above-mentioned branches of engineering. The book contains numerous cuts illustrating the application of these appliances in steam plants of various kinds. Copies of this elaborate treatise are sent free to owners, engineers and operators of steam plants, and others having direct interest in the subjects treated.

Dole Ball-Bearing Packless Radiator Valves and Dole Automatic Air Valves are featured in new circular matter issued by the Dole Valve Co., 208 North Fifth avenue, Chicago, in which views of these valves are given showing, in each case, the interior construction.

Ideal High and Low Pressure Steam Trap, Model C, manufactured by the Tillotson Humidifier Co., Providence, R. I., is the subject of an interesting 4-page circular in which are given some essential general facts regarding steam traps, as well as a detailed description of the Ideal trap. Among the general features

PATTERSON HOT WATER HEATERS

Are built in various types and styles for use with

EXHAUST or LIVE STEAM

or in connection with

LOW PRESSURE HEATING SYSTEMS

All the HOT Water wanted, as HOT as wanted, and WHEN wanted, absolutely guaranteed

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THE WEBSTER AIR WASHER

THE WEBSTER AIR WASHER is guaranteed to remove 98 per cent. of al dust, dirt, soot, etc., contained in the entering air and all gases which are soluble in water. All free moisture is entirely removed from the air leaving the air washer

THE WEBSTER AIR WASHER can, by a simple method, be arranged to control the humidity automatically.

THE WEBSTER AIR WASHER has proven extremely efficient for air cooling, and when using the spray water over and over again will cool the entering air in summer time from 4 degrees to 13 degrees and when running water is used from 5 degrees to 18 degrees below the outside temperature.

We have a well-equipped and complete experimental plant, enabling us to produce any initial air condition desired, and solve any problem which may arise. Our engineering department is at your service for the design of air washer installations, giving particular attention to special air washers for use in connection with industrial processes requiring de-humidification, vapor condensation, cooling of liquids, etc. Catalogue sent on request.

WARREN WEBSTER & CO., Camden, N. J.

Established 1888 — 24 Branches in the Principal Cities

Air Cleaning *Air Cooling* *Humidity Control*

THE ZELLWEGER
Air Washing and Cooling Fan

(Patented)

is the Most Thorough Cleaning, Lowest Cooling, Most Economical, Simplest and Most Compact Air Washing and Cooling Apparatus Yet Produced.

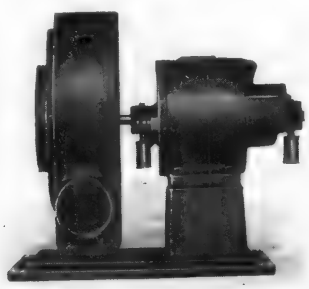
1. It resembles outwardly an ordinary Centrifugal Fan and occupies about the same space as a Standard Blower of equal capacity.
2. It combines the Four Apparati: Fan, Sprayer, Eliminator and Pump in ONE Self-Contained Machine and does their work in ONE operation.
3. It Purifies Air by Repeated, Forcible Contact with Water in a Rotating Filter Ring of many layers of close meshed Wire Screens.
4. It Cools Air from outdoors to within 2° of the temperature of the **circulating water,** which usually is from 5° to 25° below the temperature of the air and below 80° in the hottest seasons.
5. It blows the washed air either directly into rooms or buildings for **cooling** the same, or through furnaces or steam coils for **heating** purposes.
6. It requires a Minimum of Power and Water.
7. It is Self Cleaning and requires NO special attention.
8. Any Centrifugal Fan can be transformed into a Successful Zellweger Air Washing and Cooling Fan.
9. ALL Zellweger Air Washing and Cooling Fans give PERFECT SATISFACTION.

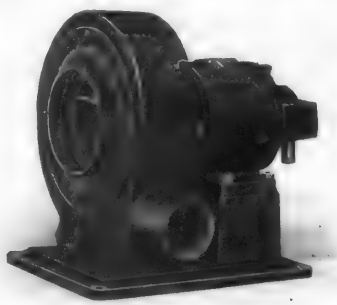
J. ZELLWEGER & SONS

1900 Adelaide Avenue **St. Louis, Missouri**

mentioned as of prime importance are a tight valve and heavy floats, which are distinguishing features of this type of trap.

Ilg Forge Blowers, one of the products of the Ilg Electric Ventilating Co., Chicago, Ill., as shown in the accompanying illustration are featured in new circular matter. This type of blower is designed to give a strong blast for one large fire.





ILG FORGE BLOWERS

The blast wheel is of solid aluminum and runs at 3,200 R. P. M. on both alternating current and direct current machines. The motors furnished on these machines are of ample power and are guaranteed to stand up. The shipping weight is 70 lbs. The company quotes prices on special sizes for any current or voltage.

Ideal Heating Journal, for February, 1912, the American Radiator Company's handsome periodicals, has, as its leading article, a description of the company's new Arco wand vacuum cleaner, which it has recently placed upon the market. These machines are manufactured and sold for single-sweeper plants only, having a capacity for the use of one line of hose, with one cleaner tool or sweeper at a time. The construction of this new vacuum cleaning machine may be seen from the accompanying illustration.

MECHANICS OF HEATING AND VENTILATING

By KONRAD MEIER

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THE FLOW OF AIR.—VII. Theory of the Flow. VIII. Air Blast at High Velocities. IX. Forced Ventilation. X. Hot Air Heating and Ventilating by Gravity.

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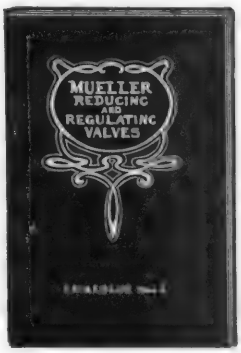

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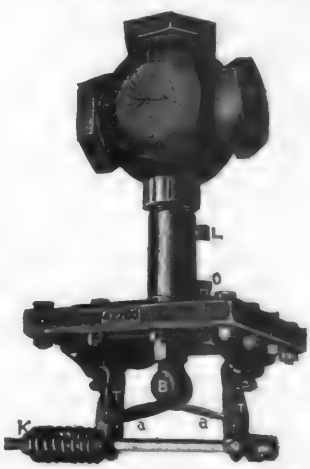

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Made in sizes ¾-inch to 12 inch. Smaller sizes 2-inch and under, are fitted with brass bodies; larger sizes have iron bodies, composition mounted and composition *renewable seats.*

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The dirt-laden air enters at the top of the separator through cleaner-main. Upon entering the sheet-metal funnel of the separator the air expands and its velocity is materially reduced, while the greater part of the dirt retains its high velocity and with the aid of gravity is precipitated into the dust bucket.

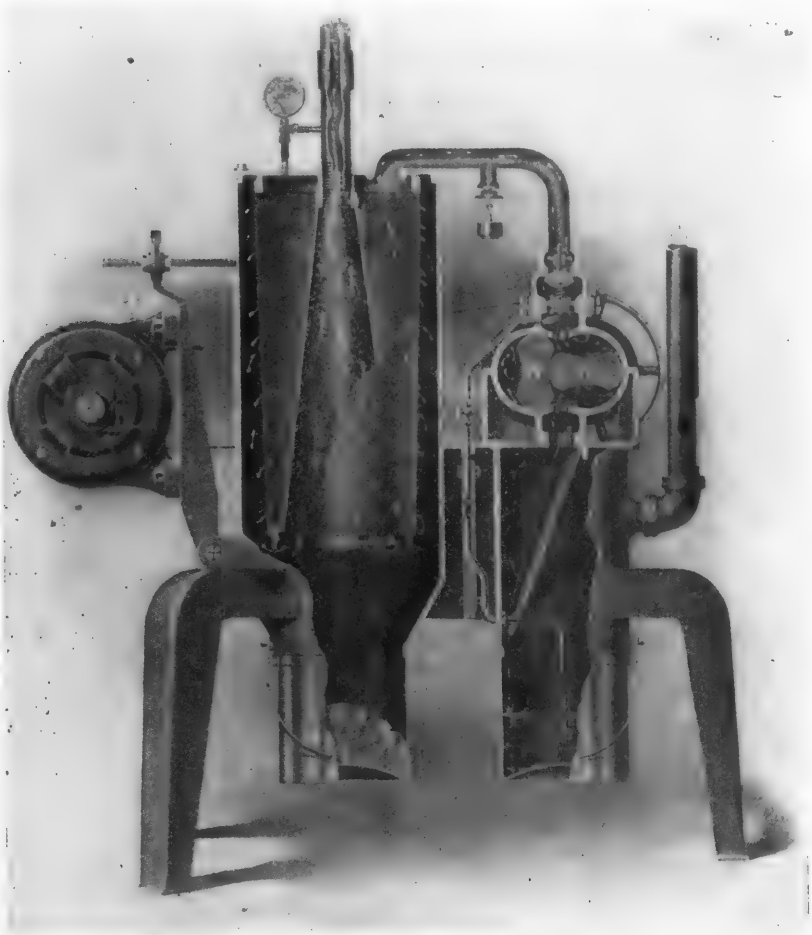
The currents of air after passing the lower edge of the sheet-metal funnel reverse their direction and move upward and pass through the cloth screen, as shown by the arrows. The screen is a double fabric, made of duck and muslin.

The condition of the screen in the separator can be tested at any time; and it can also be easily cleaned by a simple process of causing the currents of air to momentarily pass through the screen in reverse direction.

From the separator the air passes through the pipe connection to the pump, as shown by the arrows. A relief valve of the weighted type is provided in this pipe connection. The weights are adjusted according to the suction desired. Each weight is marked with a number showing the vacuum in inches, mercury column, which it represents.

Whenever the suction of the pump ceases, the check-valve, located just above the pump, seals and prevents inrush of air to the separator and piping—all inlet couplings being closed.

The air passes from the pump, which is of the rotary type, into the muffler, thence through the exhaust pipe into a vent flue or outdoors.



ARCO WAND VACUUM CLEANER

Engineering Directory for 1912 is out and is fully up to the standard established during its nineteen years of publication. It is leather bound, measures 4 x 6¾ in., contains 1496 pages, a complete cross index, and thumb indexes to the fifteen sections of the book. In the classified section, manufacturers' products are found under 3850 classifications. For those who are looking for a reliable mailing list to use in their 1912 sales campaign, attention is called to the following lists: Jobbers of mill supplies, jobbers of plumbing and heating sup-

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plies, dealers in plumbing, steam and mill supplies in Canada; jobbers of hardware, jobbers of electrical supplies, list of manufacturers' agents, alphabetical list of manufacturers of plumbing, heating and mill supplies; same manufacturers classified according to their products; railway purchasing agents, leading architects in the United States, electric light and power plants, gas companies, waterworks, trade associations and cross index to manufactured products.

The directory contains the names of more than 6,000 manufacturers, producing over 4,000 varieties of engineering goods, and having more than 50,000 trade or brand names.

This directory is published by The Crawford Publishing Company, 537 South Dearborn Street, Chicago, and is sold for $5.00 delivered.

BOOKS ON HEATING AND VENTILATION

Mechanical Equipment of Federal Buildings Under Control of the Treasury Department. By Nelson S. Thompson, chief mechanical and electrical engineer, office of the supervising architect. Second edition, revised and enlarged. Contains the basic data used in the design of the mechanical and electrical equipment of Federal buildings under the control of the Treasury Department. Also contains data for approximating the cost of the various parts of the work. The book takes in heating and ventilation, plumbing, stationary and portable vacuum cleaning plants, engines and generators, motors and controlling apparatus, forced systems of hot water heating, commercial practice in factory heating, etc., and other valuable data. Cloth, $2.00.

Central Station Heating. By Byron T. Gifford. This work presents the most advanced practice in central station heating, both steam and hot water, and is an invaluable guide, not only to the engineer, but to municipalities and public service commissions where district heating is being, or will be, used. 208 pages, with 42 figures, including 50 pages of miscellaneous engineering data. Size 6 x 9½ in., bound in flexible leather. Price, $4.00.

Mechanics of Heating and Ventilating. By Konrad Meier. Including a series of ten charts containing data relating to the flow of water, steam and air, collected by Mr. Meier during an experience of 26 years in heating and ventilating work, both in this country and abroad. Each of the charts replaces a series of tables on the subject, giving at a glance the result of a calculation from any combination of factors. 161 pages, illustrated, with ten large charts. Size 6 x 9 in. Price, $5.00. Separate sets of charts, printed on cloth, with lines in different colors and mounted on boards. Single charts, $1.50. Sets of ten charts, $15.00.

Heating and Ventilating Buildings, a standard manual for heating engineers and architects. By Prof. R. C. Carpenter. Fifth edition, largely rewritten. 577 pages, 277 illustrations, 8vo, cloth, $4.00.

Handbook for Heating and Ventilating Engineers. By Prof. James D. Hoffman and Benjamin F. Raber. The latest book on this subject. Unusually comprehensive. 320 pages, with 45-page appendix. Size 4½x6¾ in., bound in flexible leather. Price, $3.50.

Questions and Answers on the Practice and Theory of Steam and Hot-Water Heating. By R. M. Starbuck. Illustrated. $1.00.

Ventilation of Buildings. By William G. Snow and Thomas Nolan. 83 pages. Pocket size. Contains a statement of the general principles of ventilation and of their application to different kinds of buildings. Boards, 50c.

Steam Heating and Ventilation. By Wm. S. Monroe. Containing formulas and data valuable in the designing of heating and ventilating plants. Price, $2.00.

Steam-Electric Power Plants. By Frank Koester. A practical treatise on the design of Central Light and Power Stations and their economical construction and operation. 473 pages. 340 ills. Price, $5.00.

Light, Heat and Power in Buildings. By Alton D Adams, M. E. The purpose of this volume is to present in compact form the main facts on which selection of the sources of light, heat and power in buildings should be based. The problem is to determine the kind of equipment that will yield the service required at the least cost. 12mo. Cloth, $1.00.

Air-Conditioning. By G. B. Wilson. Being a short treatise on the humidification, ventilation, cooling and the hygiene of textile factories—especially with relation to those in the U. S. A. With figures. 12mo. Illustrated. 143 pages. Price, $1.20.

Practical Steam and Hot Water Heating. By Alfred G. King. Containing over 300 detailed illustrations. The book is a working manual for heating contractors, journeymen steam fitters, architects and builders. Describes various systems of heating and ventilation and includes useful data and tables for estimating, installing and testing such systems. 8vo. 367 pages. Price, $3.00.

Dean's System of Greenhouse Heating, by steam or hot water, with formulas for obtaining different temperatures, by Mark Dean. Price, $2.00.

Power, Heating and Ventilation. By Charles L. Hubbard, B.S., M.E. A treatise for designing and constructing engineers and architects. The whole subject of heating is covered, including the heating of large institutions with central plants. Space is also devoted to electrical matters connected with steam plants. 647 pages. Price, $5.00 (three volumes in one).

Notes on Heating and Ventilation. By John R. Allen. 152 Pages. 34 illustrations. Size, 4½x6¾ in. One of the new books, brought quite up to date, and containing much information to guide the intelligent steam fitter in the installation and heating and ventilating apparatus. Cloth, $2.50.

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The School House. Its Heating and Ventilation. By J. A. Moore. 204 pages, illustrated. $2.00.

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CENTRAL STATION HEATING

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Book Review.
ENGINEERING BOOK ON CENTRAL STATION HEATING
Central Station Heating.—By Byron T. Gifford. New York. Heating and Ventilating Magazine Co. Flexible leather; 6x9½in.; pp. 208; 42 illustrations. Supplied by INDUSTRIAL ENGINEERING for $4.00.

This work presents the most advanced practice in central station heating, both steam and hot water, and is an invaluable guide, not only to the engineer, but to municipalities and public service commissions where district heating is being, or will be, used.

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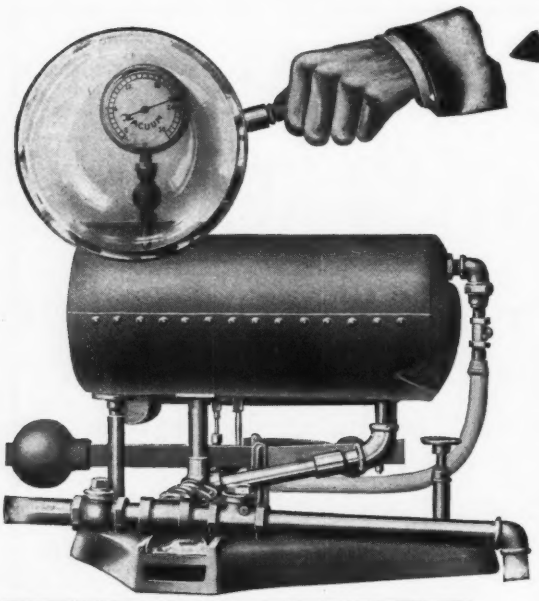

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